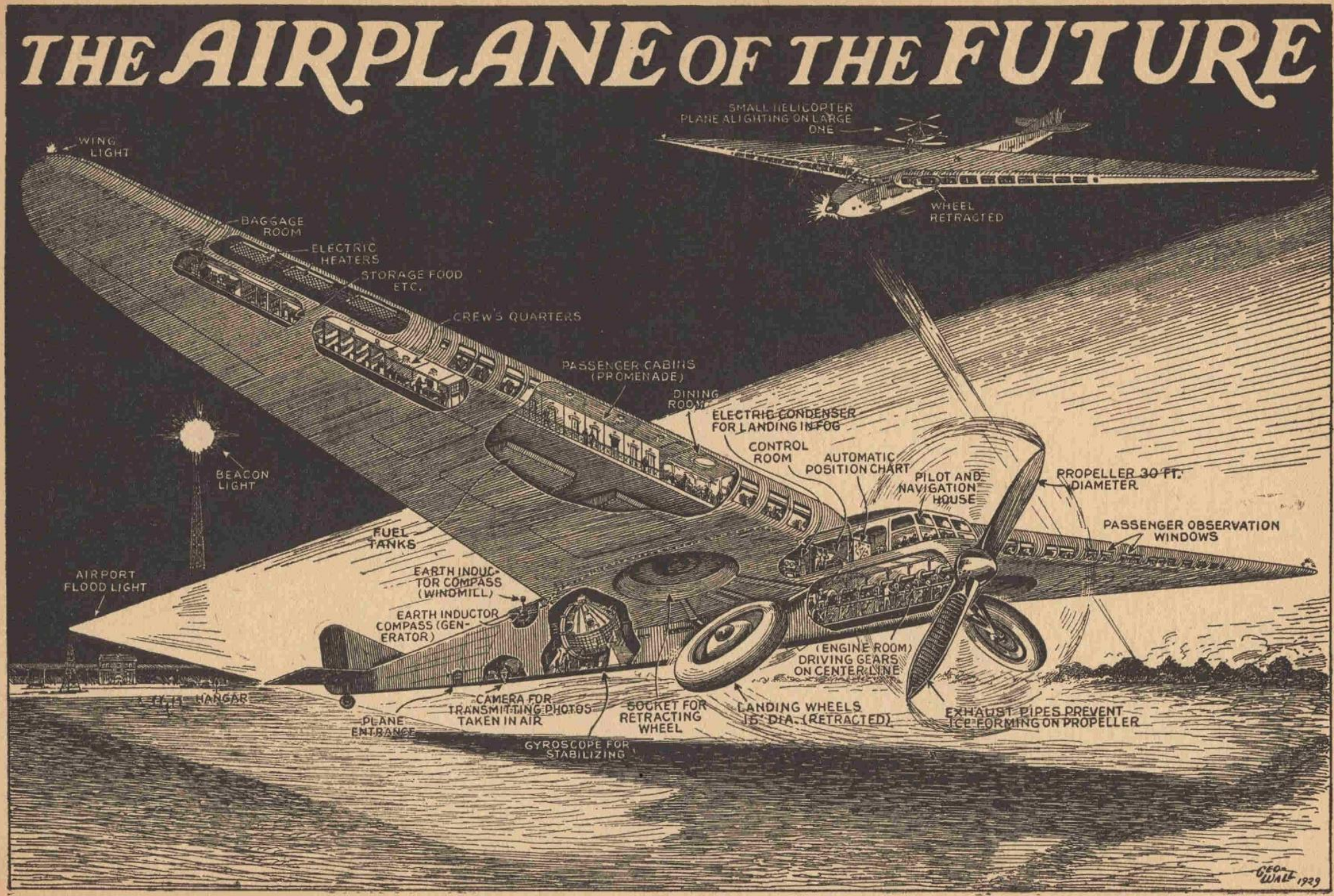
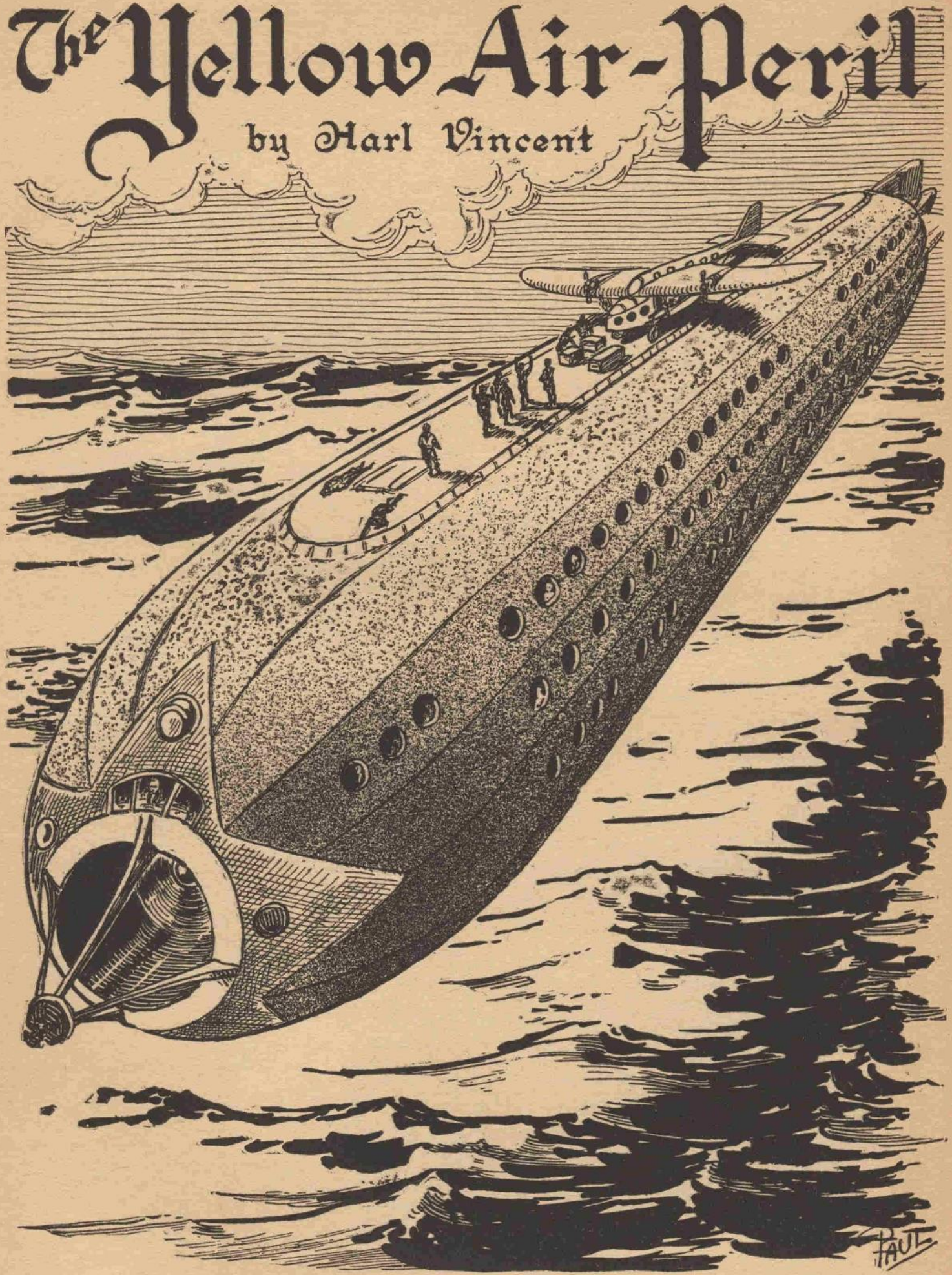


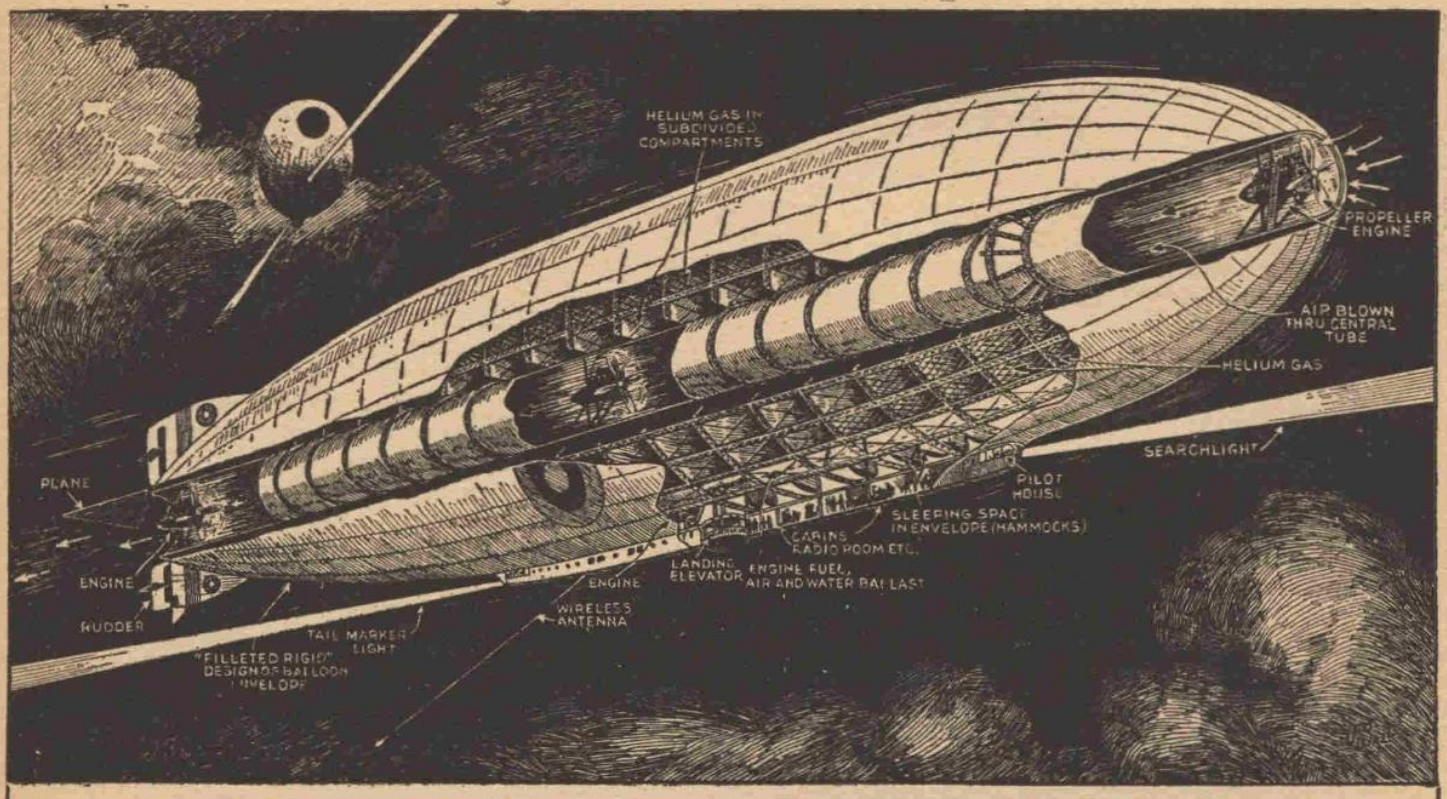
(Gyroscope—Courtesy Sperry Gyroscope Company)

The Yellow Air-Peril

by Harl Vincent



At a word from the leader they loaded the cases into the rear of the plane. All hatches atop the *Albatross* had been fastened and now there came loud thumpings and shouts from beneath one of these.



THE above illustration is a reproduction of a drawing which appeared in the September, 1919, issue of the *Electrical Experimenter*. It is interesting to note that Mr. H. Gernsback predicted this type of machine, which the author of this story has also made use of. Moreover, we understand that such a machine is about to be tried out very soon.

The idea in a few words may be summarized as follows:

The Zeppelin type of airship has now an exterior power plant, which is underslung beneath the airship.

Mr. Gernsback has created a huge wind tunnel and installed the engines at various points in the tunnel. This arrangement creates a terrific suction, and the airship literally sucks itself through the air.

The advantages claimed by Mr. Gernsback are that wind resistance from the power plants is done away with; and accidents like that which recently befell the *Graf Zeppelin*, when several of the power plants went out of commission, are not likely to happen in this arrangement.

It should be easier to navigate an airship of this kind, because the wind-thrust against the underslung propellers of the old type is wholly wanting. Furthermore, the power plants are protected from the elements and repairs can be made with comparative ease while the airship is in flight.

and pallid features to the grimness of Roger's, "this is quite different from the trip we had planned. I wonder what is to become of us."

The professor seemed incapable of speech, but Roger's expression changed to one of worried abstraction and he appeared to be speaking his thoughts aloud as he replied.

"It is a peculiar procedure," he said. "I can understand their reasons for sparing your father's life—quite likely they are not sure they can completely solve his secret without instruction from him. But you—I can't see why they want to bring you along. Nor myself. What good we can be to them is beyond me. If they intend to kill us they might have done it more quickly and easily before we left. It's funny."

Professor Ingalls' eyes recovered their former luster and snap. "I'll never tell them," he averred. "Without certain information I have kept securely locked in my own brain they are helpless. The apparatus is there, to be sure, but without my aid it is useless to them. I shall not permit them to plunge our world into the hell of a devastating war even though my own life is forfeit."

Roger pursed his lips. He thought he understood now why they had kidnaped Irene—they would use threats against her to coerce the old man—but he did not voice his fears. He still was unable to account for his own presence aboard the swiftly flying plane.

The *Albatross* was left far behind and its lights receded rapidly, finally being lost to view as the great cabin plane of the enemy climbed higher and sped continually in what Roger took to be a northwesterly direction.

"Wonder where they'll take us, he ventured.

"Not to China, I hope," said Irene.

"No," said the professor, "I do not believe we are going that far—yet. They have divisional headquarters throughout the world and will undoubtedly take us to the nearest. This just goes to show how inefficient and slow-moving our government is. More than four years ago I reported my findings during the Mongolian expedition and I have been hammering at it ever since. Of course I did not report the results of my experiments since they were still in an uncompleted state. But I have repeatedly warned the authorities and suggested an investigation of the activities of the enemy in our own country. What have they done? Nothing. Either they think I imagined the whole thing or else they have just tabled my reports and recommendations and forgotten it as the idle dream of a crazy old scientist. Now, when they get the reports from the *Albatross*, some action may be forthcoming—perhaps!"

He spoke bitterly and a silence ensued.

The steady thrum of the motors was muffled by the soundproof walls and the double windows so that conversation in an ordinary tone of voice was not difficult. But the prisoners did not converse at any great length for the next hour. Each was occupied with his own thoughts and these were not particularly hopeful or pleasant. Irene worried about her father and he was in an agony of spirit as he came to the realization of what horrors might befall his cherished daughter at the hands of the conscienceless barbarians who had captured them. Roger thought mainly of the girl also—a shiver of dread came over him at thought of her fragile beauty in the clutches of such creatures as had murdered the captain and Calkins. The possible catastrophe to the world gave him scarcely a thought.

A GERNSBACK PUBLICATION

AIR WONDER STORIES

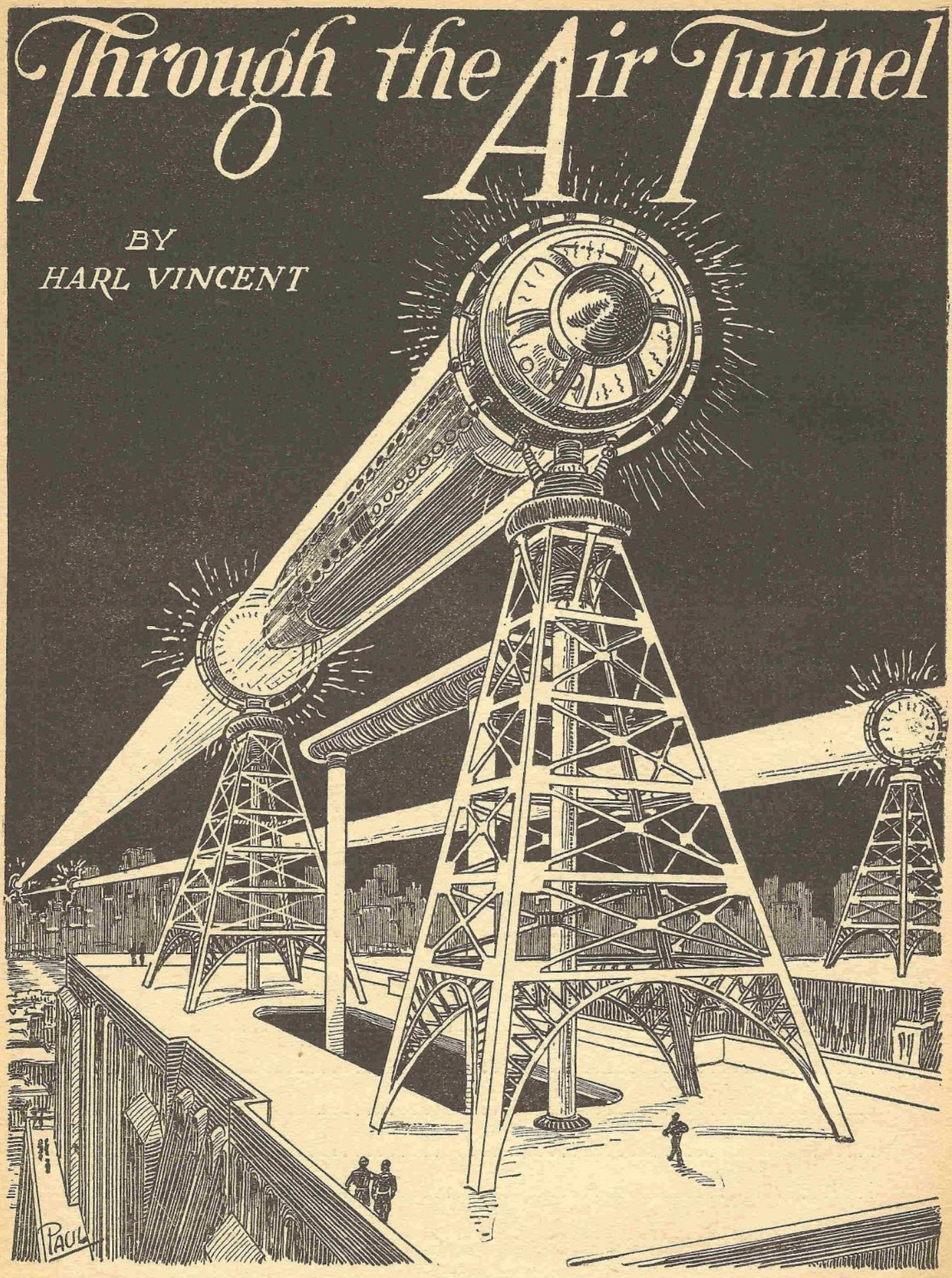
OCTOBER
1929
25 CENTS
Canada 30¢

HUGO GERNSBACK
Editor

Science-Aviation Stories
by
ED. EARL REPP
HARL VINCENT
HENRIK DAHL JUVE

Through the Air Tunnel

BY
HARL VINCENT



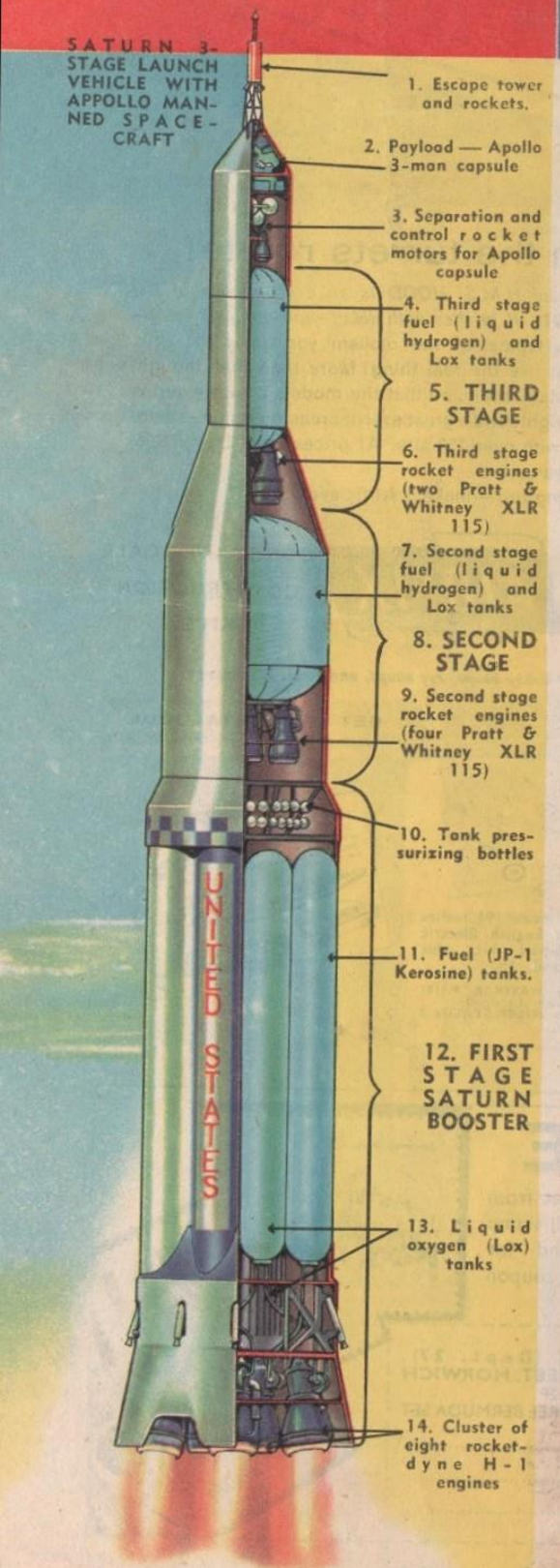
Arm in arm they left the station. Two hundred feet above their heads streamed westward the two orange beams that were the east and westbound tunnels, forming two great pencils of light.

VALID FOR... LAND... SEA... AIR

1ST CLASS

TICKET TO ADVENTURE

JOURNEY TO THE Moon



YOUR alarm clock wakes you up. At first it's hard to believe your eyes . . . It's TWO THIRTY IN THE MORNING!

"Am I seeing straight?" you ask. The answer is an instant, 'Yes.'

Within seconds you're out of bed and putting on some of the strangest-looking clothes you've ever climbed into on a cold morning. It still won't seem true until after the countdown in about two hours' time, but your *Ticket to Adventure* has been stamped 'Space Flight.' You are actually going on a journey to the Moon!

But let's get back to those awkward-looking clothes, carefully designed for you by the scientists. You'll find it difficult to walk about in them, because of their exceptionally heavy weight. That is to prevent you floating into the air when you reach the moon's gravity-free surface.

The scientists still haven't finally discovered whether or not the moon's actual surface is solid, or whether it is made up of a deep layer of fine dust—which could easily swallow a space-craft! Time . . . and YOU . . . will tell! Now you are in your space-craft, and the final countdown begins " . . . TWO . . . ONE . . . ZERO!" A mighty roar tells you the gigantic booster has fired your rocket on its first stage journey to the Moon.

Be prepared for at least one 'stop' in space. This will be necessary so that you can refuel from an orbital space station. By now you will have become quite used to the equipment you're wearing. Quite rightly it is called 'survival equipment.' Without its built-in oxygen supply you wouldn't live long enough to explore the fantastic planet you are now rapidly approaching.

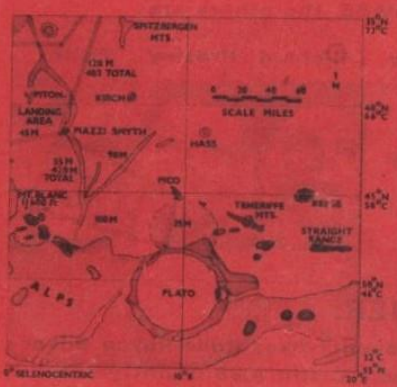
The side of the moon we can't see. This was photographed by a spacecraft.

Another controlled explosion from your space craft tells you that the downward firing retro-rocket has been launched TOWARDS the moon. This is to slow down the speed of the space-craft to allow a 'soft' landing. Your instrument will set a course correction and then the cushioned landing begins. Padding all around you will protect you—since the term 'soft' is only used as a contrast to the other kind of landing that would bury your craft up to half-a-mile deep, making yet another moon crater!

If you've been following your route between earth and moon you'll realise that you have travelled what the space scientists call an 'economy route.' This means that instead of shooting from planet to planet in a STRAIGHT line (impossible as yet, because of the high speeds and boosters required) you have gone into orbit, before 'coasting' the rest of the way in unpowered flight. Radio commands from Central Control on earth have been used to stop and restart your rocket engines, keeping you on course.

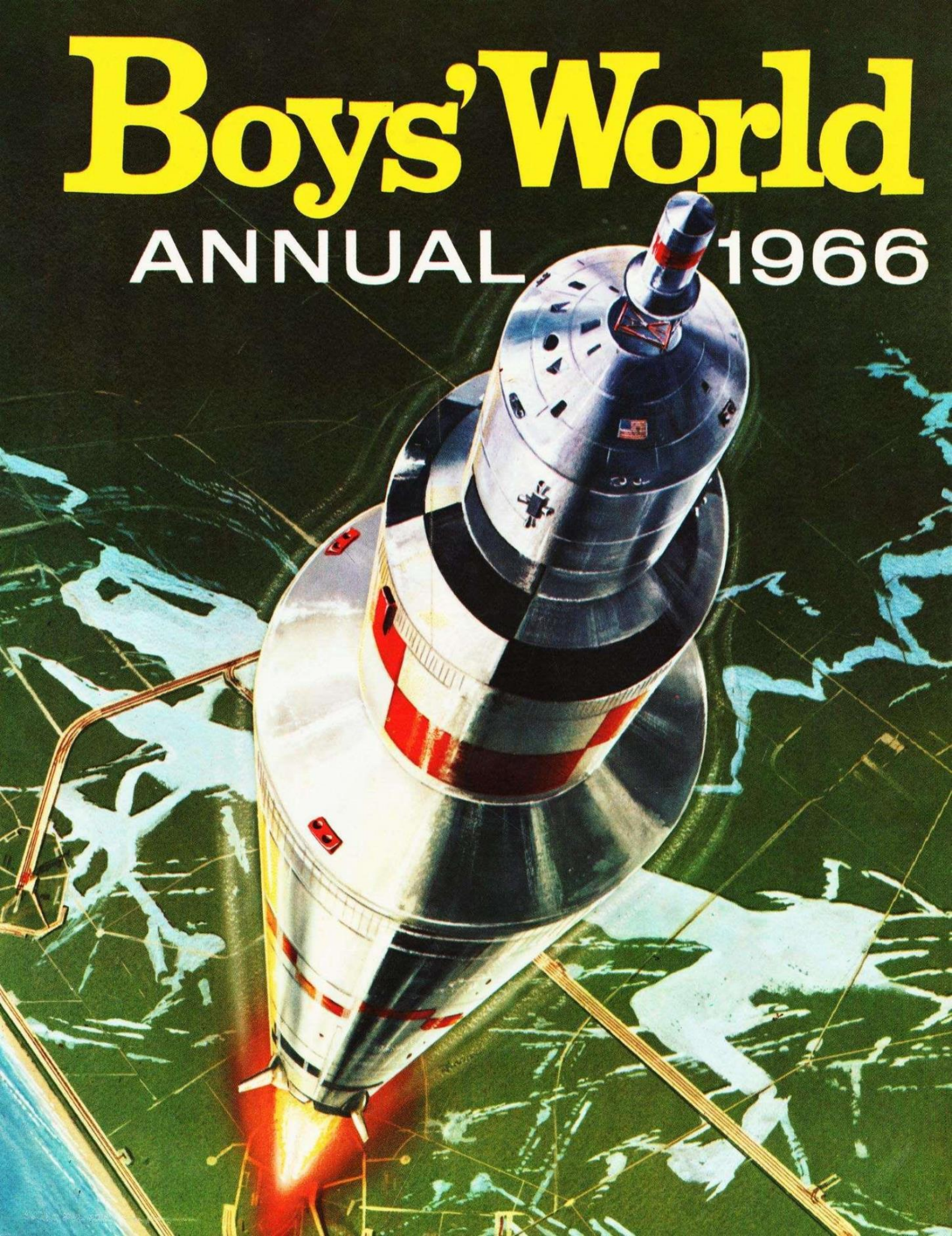
Get ready now to enjoy the weightlessness resulting from low gravity as you leave the space ship to set foot on the moon's surface. You can do with a stretch after the WHOLE WEEK it's taken to get here. If you're hoping to take a longer space trip—sometime in the future, this moon trip makes a good training flight as a start. And, in a few years' time, these journeys may happen more often than anyone today cares to think . . . and who, knows, maybe you'll be the real-life pilot on one of these thrilling flights.

This is where you would probably land. The temperature here is quite reasonable, and the surface comparatively smooth. On the right of the map is *Surveyor*, an unmanned space-craft for 'soft' landing on the moon. Its TV cameras would transmit pictures to earth.



Boys' World

ANNUAL 1966



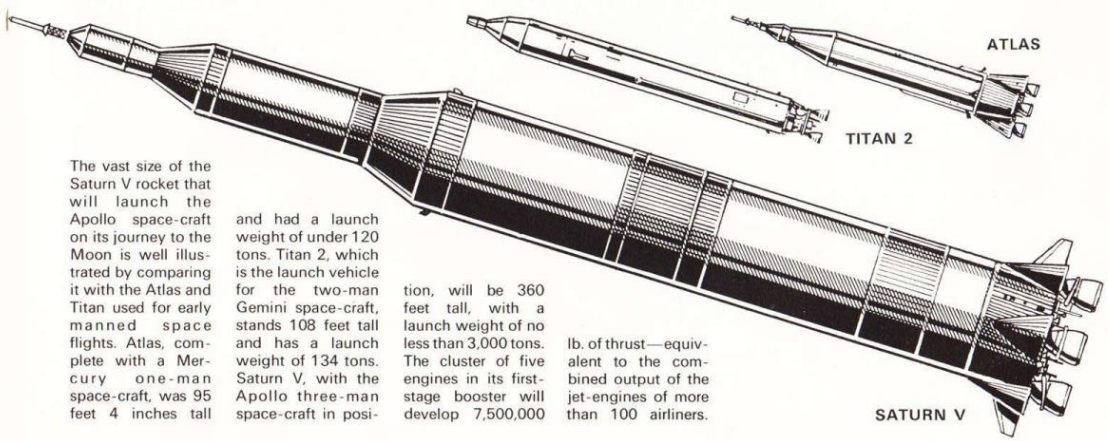
JOURNEY TO THE MOON

NO voyage of discovery has ever demanded greater courage than the journey to the Moon. It will not be a step into the unknown, as were the voyages of sailors like Columbus and Sir Francis Drake. Long before an astronaut sets foot on the Moon, we shall study photographs of the Lunar landscape, sent back by robot explorers. We shall know whether the surface is firm or made of dust or soft, crunchy rock that might, in some places, swallow a complete spaceship in a few seconds. We may even have surveyed by remotely-controlled vehicles the exact spot on which the first space-craft will touch down. But there is one aspect of the Moon-journey that makes it different from any voyage of discovery on Earth—and far more hair-raising.

If Columbus had been ship-wrecked, he could probably have found sufficient food to stay alive. With his crew, he could have tried to build another ship, or even have had some hope of being rescued by other sailors. The first men on the Moon will be less fortunate. If, for any reason, they fail to make a good landing on the surface, or experience major trouble that prevents a take-off within a short period, there is nothing that anyone will be able to do to help them. In a cold and barren world, without vegetation or water, they will soon die.

When we remember the equipment failures and other problems encountered during the comparatively simple orbital flights around the Earth by America's Mercury manned satellite capsules, it becomes clear how greatly the Moon explorers will have to trust the skill of those who designed and built their space-craft.

No effort or money is being spared by America's National Aeronautics and Space Administration (NASA) to justify such trust by the astronauts who are training to go to the Moon under Project Apollo. Dummy Apollo space-craft have been put into orbit successfully by smaller versions of the Saturn rocket that will be used for the actual Lunar launching. The rocket escape system that would carry the space-craft clear of the Saturn if something went wrong during the launch has been tested and proved satisfactory. The astronauts themselves are receiving years of thorough training. The target date for their half-a-million-mile return flight is 1969–70.

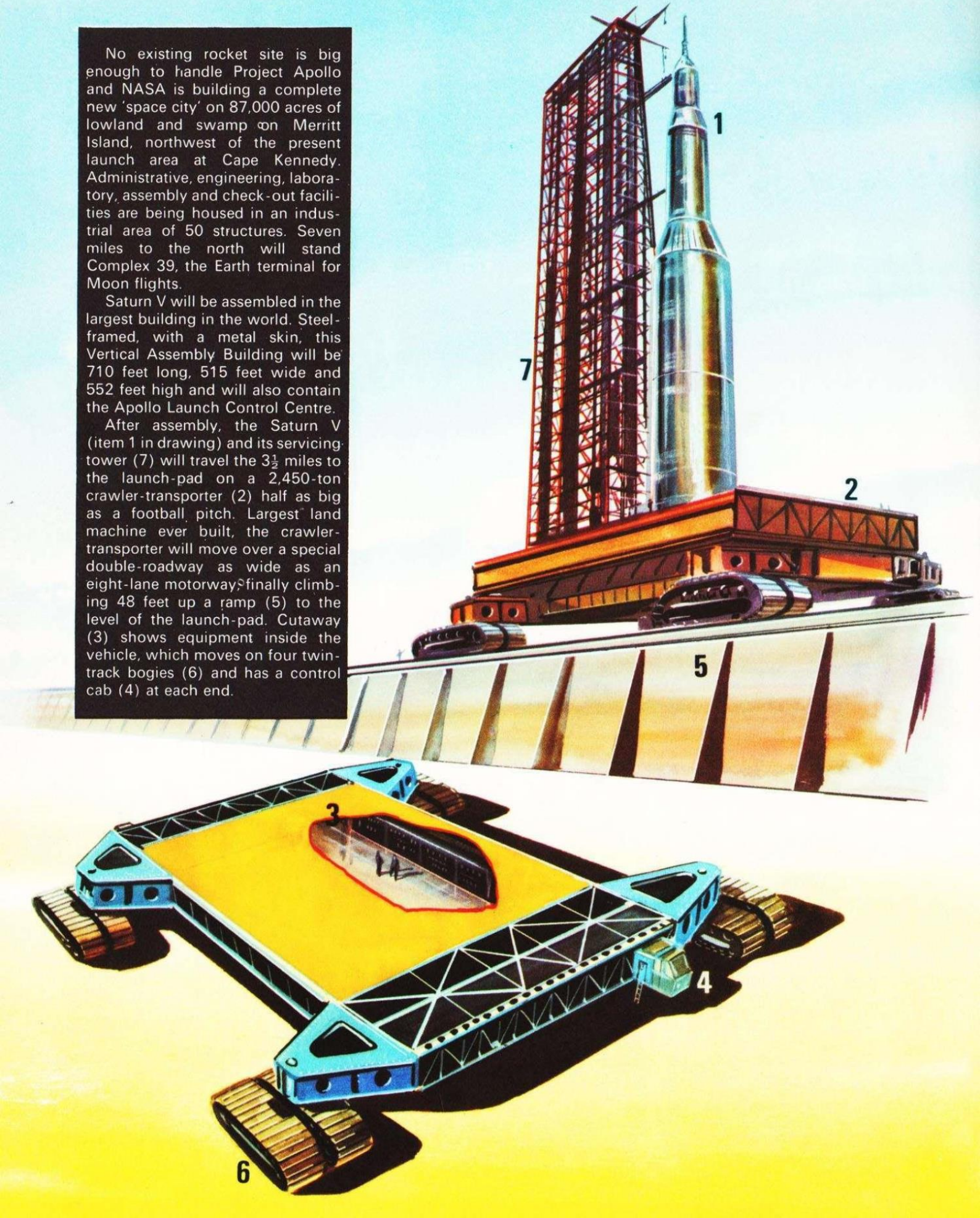


The vast size of the Saturn V rocket that will launch the Apollo space-craft on its journey to the Moon is well illustrated by comparing it with the Atlas and Titan used for early manned space flights. Atlas, complete with a Mercury one-man space-craft, was 95 feet 4 inches tall and had a launch weight of under 120 tons. Titan 2, which is the launch vehicle for the two-man Gemini space-craft, stands 108 feet tall and has a launch weight of 134 tons. Saturn V, with the Apollo three-man space-craft in position, will be 360 feet tall, with a launch weight of no less than 3,000 tons. The cluster of five engines in its first-stage booster will develop 7,500,000 lb. of thrust—equivalent to the combined output of the jet-engines of more than 100 airliners.

No existing rocket site is big enough to handle Project Apollo and NASA is building a complete new 'space city' on 87,000 acres of lowland and swamp on Merritt Island, northwest of the present launch area at Cape Kennedy. Administrative, engineering, laboratory, assembly and check-out facilities are being housed in an industrial area of 50 structures. Seven miles to the north will stand Complex 39, the Earth terminal for Moon flights.

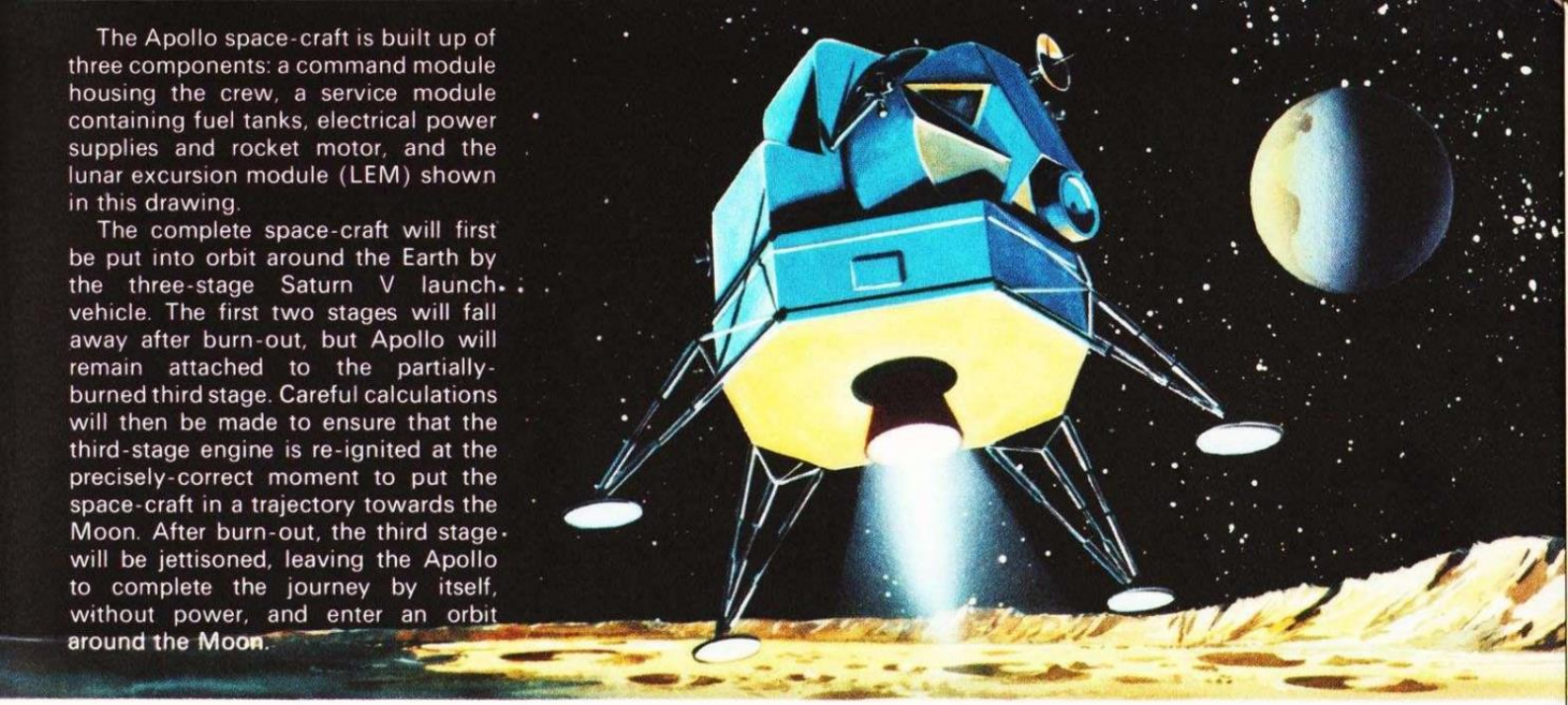
Saturn V will be assembled in the largest building in the world. Steel-framed, with a metal skin, this Vertical Assembly Building will be 710 feet long, 515 feet wide and 552 feet high and will also contain the Apollo Launch Control Centre.

After assembly, the Saturn V (item 1 in drawing) and its servicing tower (7) will travel the $3\frac{1}{2}$ miles to the launch-pad on a 2,450-ton crawler-transporter (2) half as big as a football pitch. Largest land machine ever built, the crawler-transporter will move over a special double-roadway as wide as an eight-lane motorway, finally climbing 48 feet up a ramp (5) to the level of the launch-pad. Cutaway (3) shows equipment inside the vehicle, which moves on four twin-track bogies (6) and has a control cab (4) at each end.



The Apollo space-craft is built up of three components: a command module housing the crew, a service module containing fuel tanks, electrical power supplies and rocket motor, and the lunar excursion module (LEM) shown in this drawing.

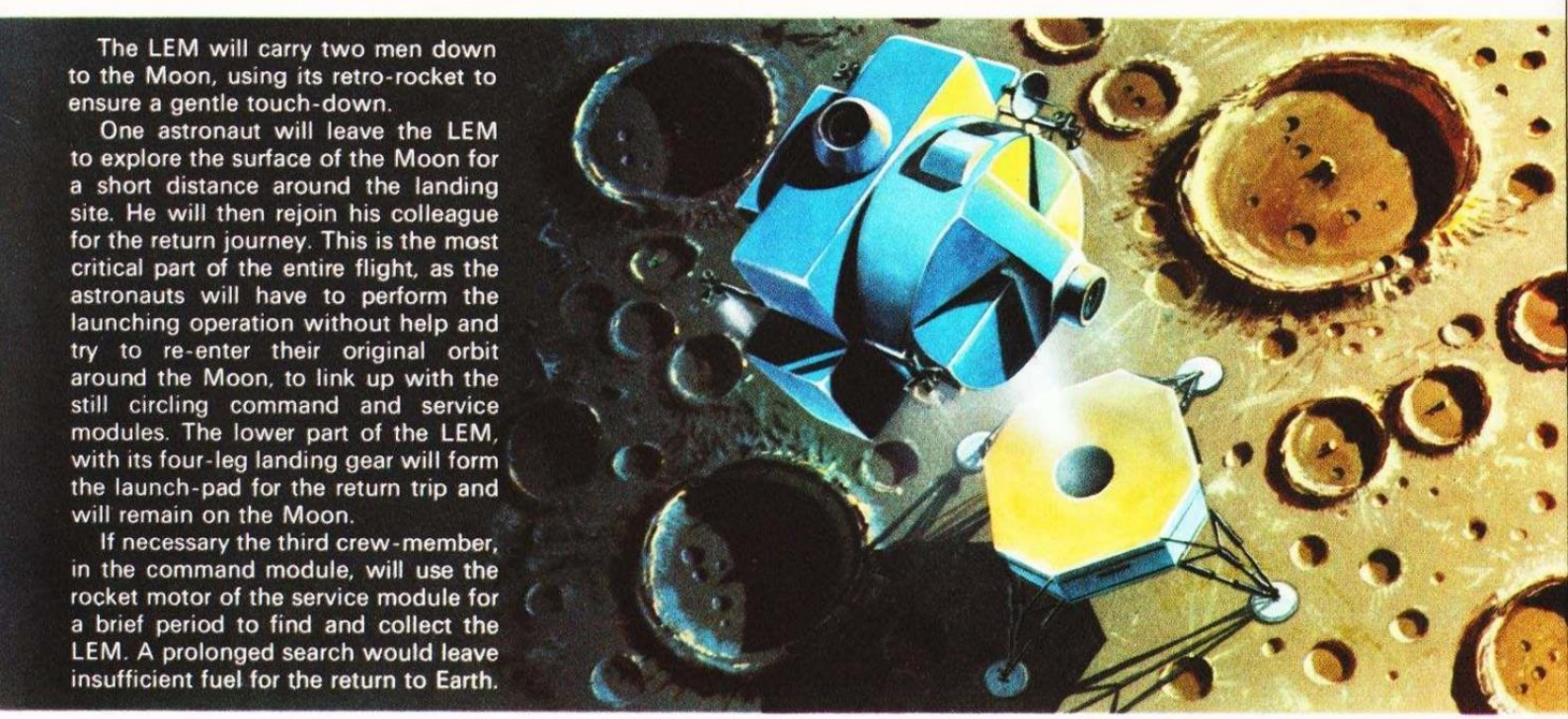
The complete space-craft will first be put into orbit around the Earth by the three-stage Saturn V launch-vehicle. The first two stages will fall away after burn-out, but Apollo will remain attached to the partially-burned third stage. Careful calculations will then be made to ensure that the third-stage engine is re-ignited at the precisely-correct moment to put the space-craft in a trajectory towards the Moon. After burn-out, the third stage will be jettisoned, leaving the Apollo to complete the journey by itself, without power, and enter an orbit around the Moon.

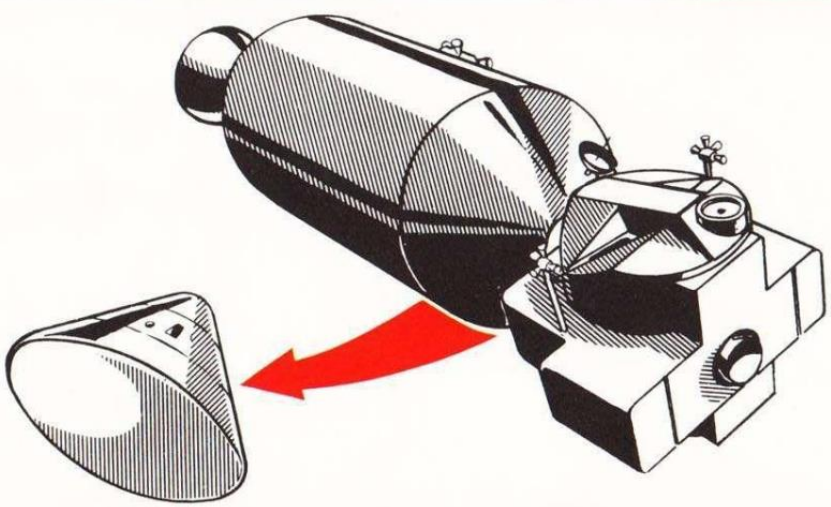


The LEM will carry two men down to the Moon, using its retro-rocket to ensure a gentle touch-down.

One astronaut will leave the LEM to explore the surface of the Moon for a short distance around the landing site. He will then rejoin his colleague for the return journey. This is the most critical part of the entire flight, as the astronauts will have to perform the launching operation without help and try to re-enter their original orbit around the Moon, to link up with the still circling command and service modules. The lower part of the LEM, with its four-leg landing gear will form the launch-pad for the return trip and will remain on the Moon.

If necessary the third crew-member, in the command module, will use the rocket motor of the service module for a brief period to find and collect the LEM. A prolonged search would leave insufficient fuel for the return to Earth.





This picture shows the LEM re-connected to the command module, so that the Moon explorers can rejoin the third crew-member. The LEM will then be cast adrift.

After more calculations, checked by radio with technicians at Cape Kennedy, the rocket-motor of the service module will be ignited to put the Apollo on course for Earth. Only the cone-shape command module will re-enter the atmosphere, protected from the intense frictional heat by an ablative (burn-away) plastic coating. It will complete the final stage of its journey by parachute.

The space-suit worn by Apollo astronauts has been specially designed to keep them comfortable on the surface of the Moon, or in space, for periods of up to four hours. The back-pack supplies oxygen and ventilation, controls temperature and humidity and removes respiratory and body contaminants inside the suit. It looks heavy but, because of the Moon's low gravity, will appear to weigh only one-sixth as much as it does on Earth. The astronaut who leaves the LEM will probably spend his time collecting samples of rock, taking photographs and performing a variety of tasks set by scientists.

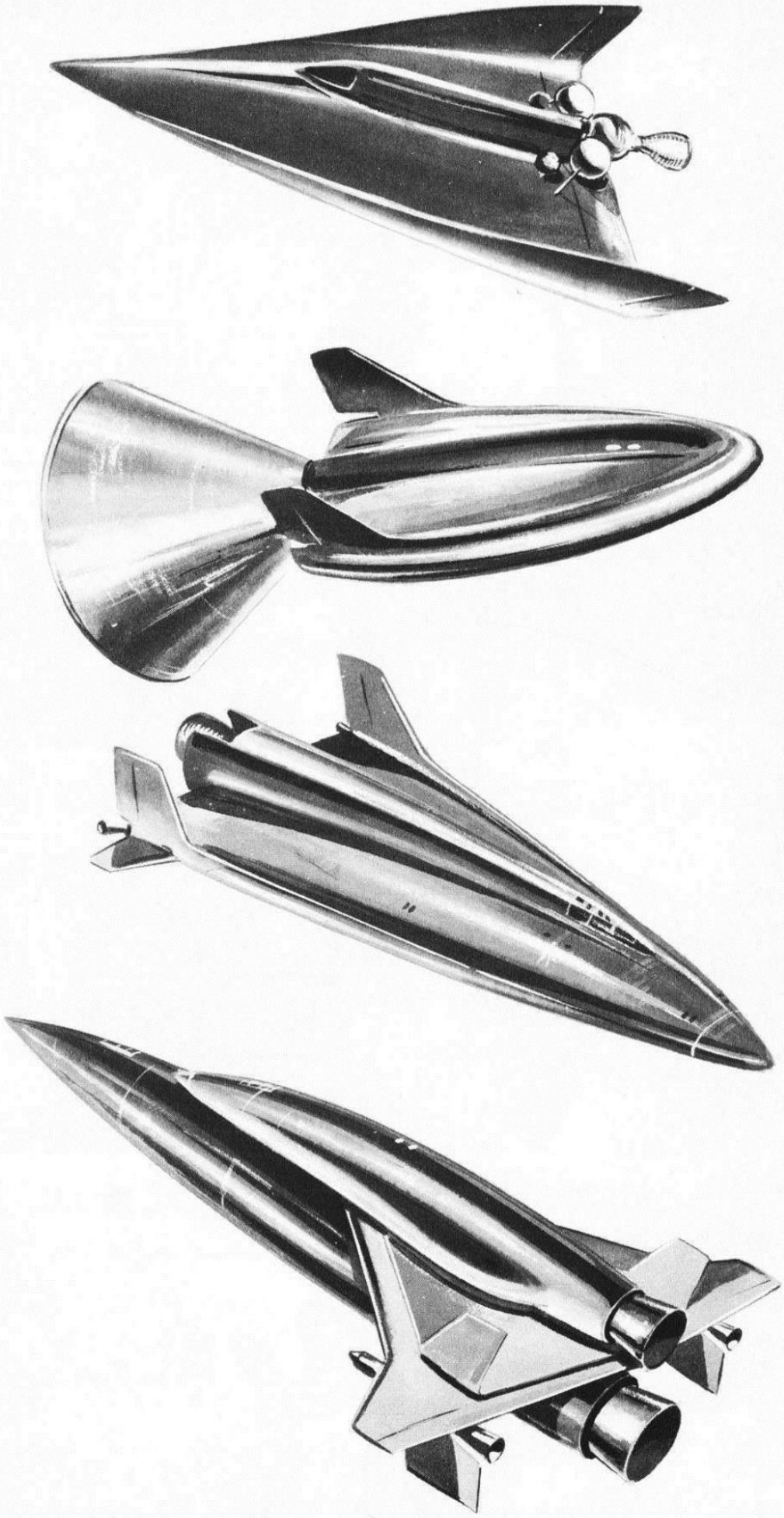
The previous five pages have shown how America plans to send men to the Moon within a few years, but much research must be done before the journey can begin. Some U.S. and Russian astronauts who have made orbital flights around the Earth have experienced bouts of sickness. We must be certain that this would not affect Apollo crews so seriously that they would be unable to do their jobs. We must also be sure that they would not receive dangerous amounts of radiation during their long journey.

So far, too, we know only a little about the lunar surface. Photographs taken by America's Ranger 7 probe before it slammed into the Moon in July 1964 indicate that the surface should be hard enough for the twelve-ton LEM to land safely. But what happens if later probes, able to land on the Moon and radio back details and pictures of the surface, show that it is covered with soft rock or dust?

Fortunately, the journey to the Moon is only one of many adventures awaiting astronauts in the last 35 years of this century. There will be no need to travel a quarter of a million miles to find useful jobs to perform in space. Long before the end of the century, giant space stations will encircle the Earth, packed with laboratories and manned by scientists, astronomers, medical research teams and engineers.

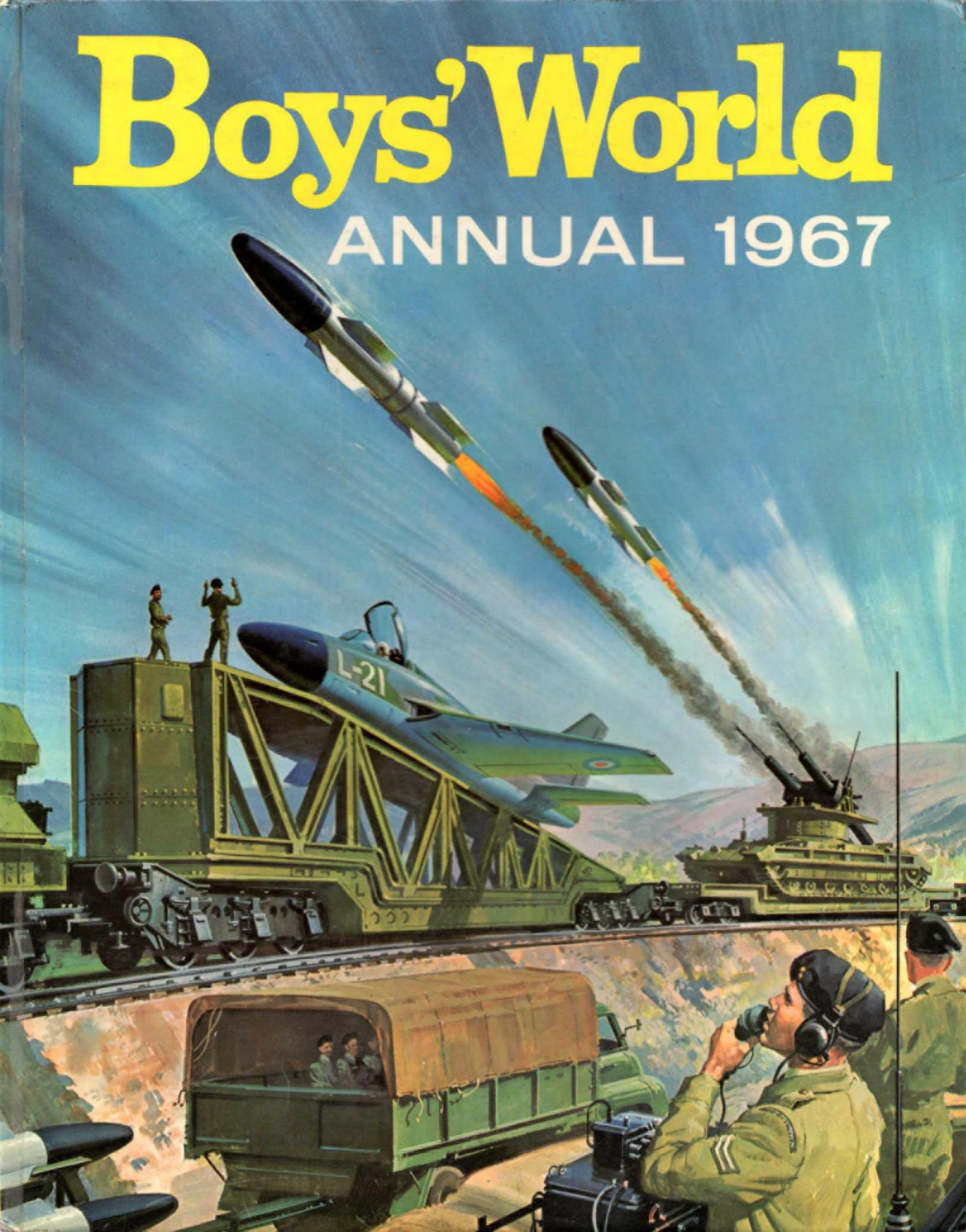
The drawings on this page show vechicles that have been designed to carry men to and from such stations. They all resemble delta-wing aeroplanes, because such craft must be controllable in the atmosphere so that they can be landed accurately at space-ports on Earth. The top two space-craft, designed respectively by the Martin and Boeing companies, are each intended to ferry twelve men between Earth and space-stations, and would be launched vertically by a large rocket booster. Next comes a Douglas design for a vehicle that would be used primarily to carry men to service and repair unmanned satellites in orbit.

Rather different is the bottom design, by Lockheed, as this 168-feet long aerospace transporter would be launched horizontally by the recoverable rocket sled on which it is mounted. After burn-out of the rocket motor, the space-craft would separate and continue the journey alone. The sled, also piloted, would use jet-engines for its return to base.



Boys' World

ANNUAL 1967



All Action Trains

TRAINS have many more exciting functions than the carrying of passengers and freight. In time of war, particularly, military units employ the railways not only to move troops and vital supplies, but also in a more offensive role.

In the early years of the Second World War, when England waited for the German invasion, one defence precaution was the placing of mobile heavy guns to protect the coastline. These guns ran on railway tracks and were positioned at strategic points with their line of fire directed at the beaches. They were, however, frequently used in an anti-aircraft role against raiding enemy bombers.

These armoured trains operated from their own sidings, and included special coaches in which the gun crews lived while on duty. The military authorities controlled the trains, and all enginemen and guards, ordinarily civilian railwaymen, were attached to a military unit during the emergency.

A mobile gun is used against enemy aircraft during the Second World War

The massive machine in the picture on the right is a steam-driven rotary snow-plough, hard at work clearing the snow-bound mainline in the Bernina Pass in eastern Switzerland.

The ordinary "wedge" type plough normally used on British Railways would be of little use in the tough conditions encountered in the Swiss mountains. In such country it is not uncommon for the snow to reach a level depth of 17 feet, and drifts up to 40 feet or more occur on more exposed sections of the line. In such a situation, steam has to come to the help of electricity, hence the steam-driven ploughs.

The rotary plough cuts a channel clean through the deep drifts of snow by means of knife-like blades fixed at an angle to the big wheel on the front of the train. When the wheel revolves rapidly, the snow is hurled to one side of the track in a great arc, and little or no spade work is necessary afterwards.

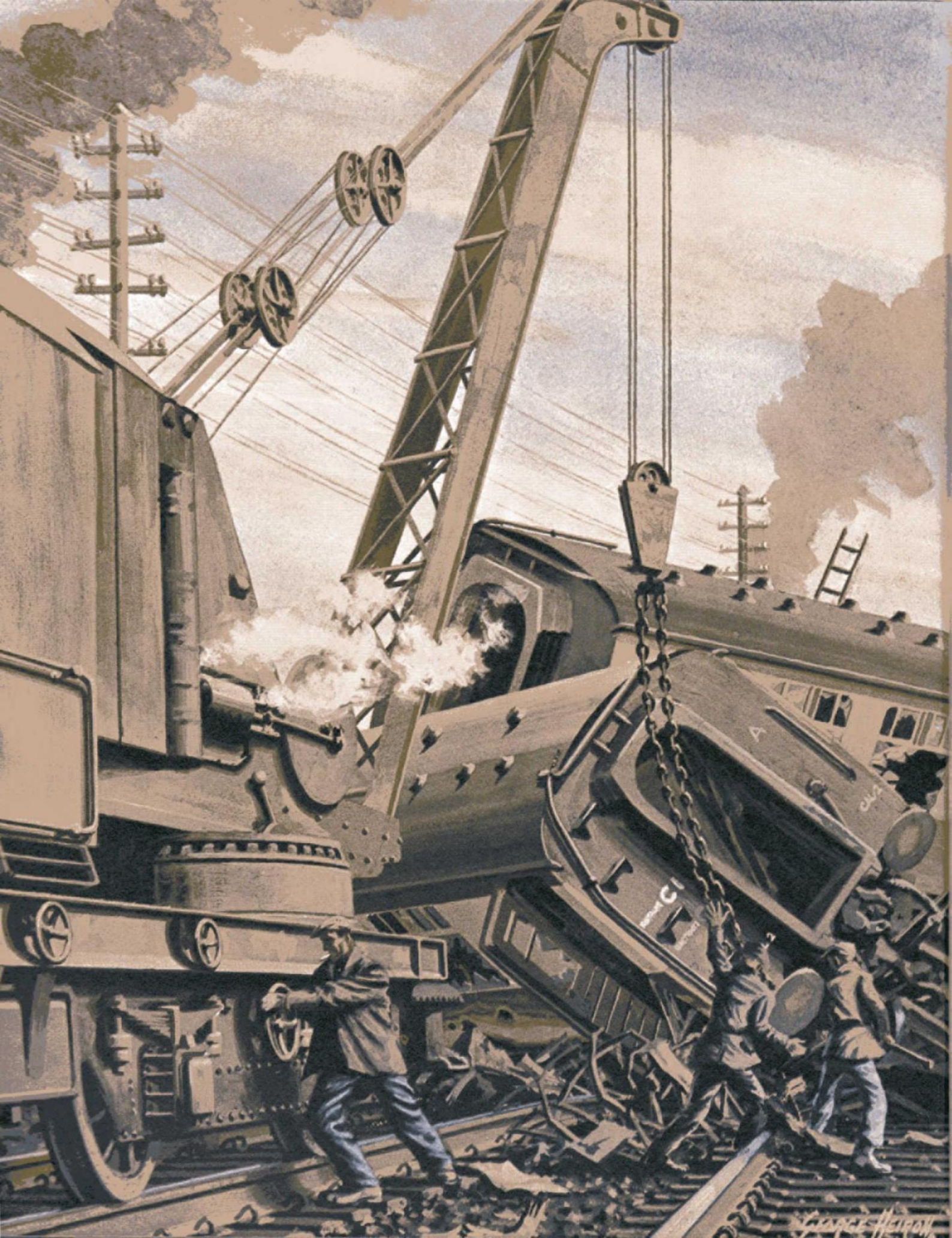
To help the snow-plough with the job of keeping the lines clear, concrete tunnels, or snow-sheds as they are called, are built over the tracks at many places on the mountain-sides. The avalanches that regularly thunder down from the high places are deflected over the railway and carried safely on into the valleys far below.

Switzerland is by no means the only country to use a rotary plough for keeping its railway lines free from snow. Canada and the United States also have railway systems that traverse mountainous countryside and, as in Switzerland, the rotary plough is the only effective means of keeping the traffic rolling.

British Railways are considered to be the safest in the world, but unfortunately accidents sometimes happen on even the best conducted

A powerful steam-driven snow-plough cuts through the snow in Switzerland

GEORGE HERRON



All Action Trains

railway systems. When the permanent way has been blocked by a derailment, first consideration, apart from the preservation of human life, is given to the task of clearing the track.

At all the most important engine sheds, there are specially trained emergency squads, equipped with heavy plant and tool vans, always ready to deal with breakdowns and other mishaps. Each shed is responsible for a certain region of the railway network in its area, and on receiving information, usually by telephone, that there has been a derailment on any of its lines, the special breakdown gang is quickly on the spot.

If any member of the gang is off duty, he is called from his home, in view of the urgency of the task. The first locomotive available is commandeered to haul the breakdown train and its crew to the scene.

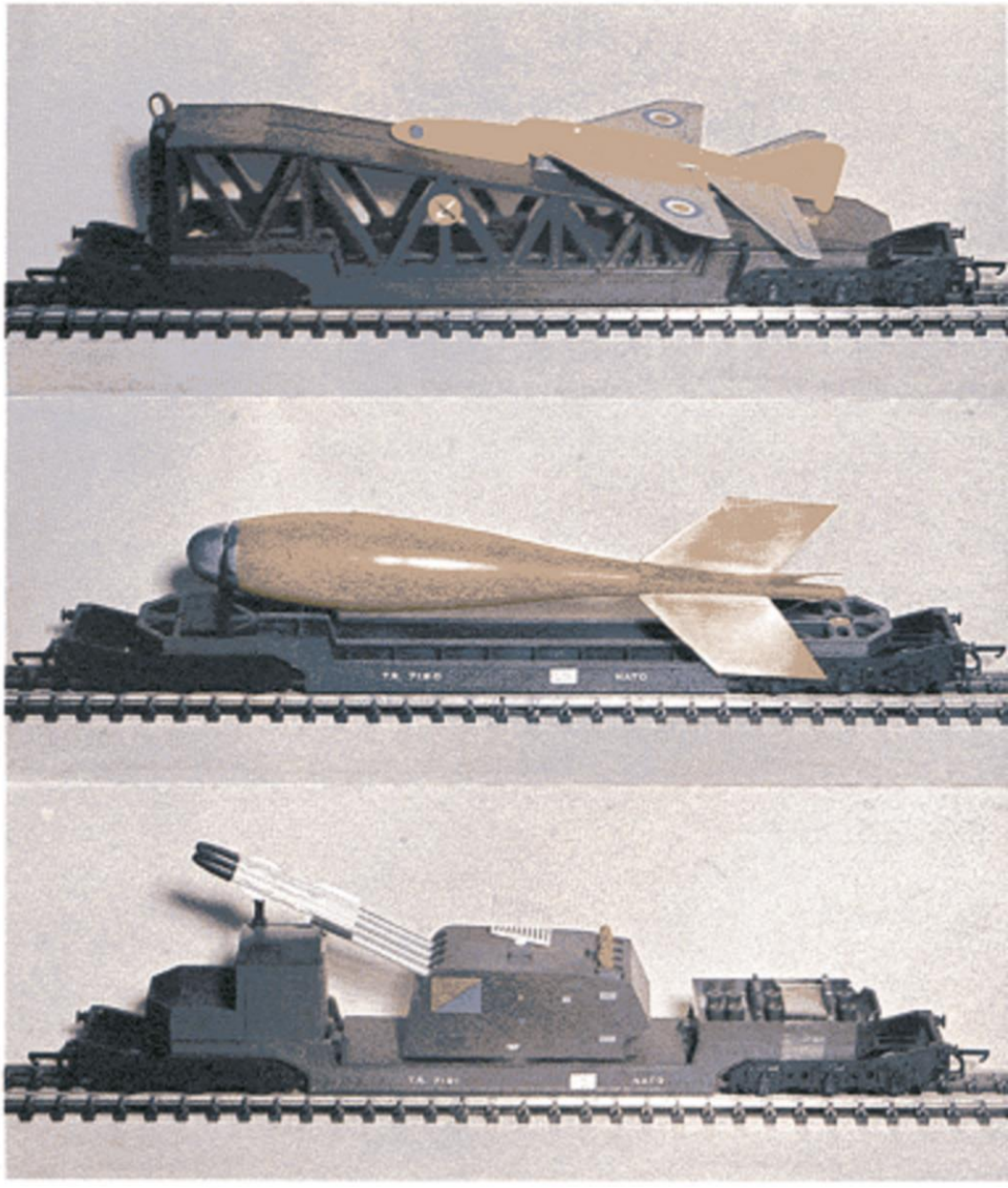
The biggest piece of equipment in the breakdown train is the giant crane, which is designed to run over the lines with its jib lowered so that it can pass under bridges and tunnels. In the event of a serious accident at least two of these cranes might be needed, which, between them, would be capable of lifting a locomotive weighing 106 tons off the ground, and putting it back on the track.

Trucks and coaches that are not damaged beyond recovery are also lifted back on to the line, to be towed away to the carriage sheds for repair, but vehicles that are smashed or telescoped are broken up on the spot and the pieces loaded into trucks for removal to a scrap heap. When the job of the breakdown train is completed, it returns to the engine sheds and the engineers move in to re-lay the damaged track.

An emergency squad of British Railways at work at the scene of a crash

COVER PICTURE

The drawing on the cover of our Annual is an artist's impression of what the *Triang/Hornby* Strike Force 10 Train Set might look like in a real life situation. These "Battle Space" train sets certainly add excitement to your model railway layouts: illustrated below are three of them. At the top is the Strike Force 10 Set, on which the cover picture is based, consisting of a Synchrosmoking Locomotive, a Catapult Plane Launching Car, and an Assault Tank Transporter with twin missile firing tank. In the centre are a Red Arrow Bomb Transporter, with an exploding bomb and, at the bottom of the page, a Multiple Missile Launcher with rotating firing tower.



10p

EAGLE

ANNUAL 1975

A FLEETWAY ANNUAL

LOOKING INTO SPACE

The next ten years will prove a most exciting time for astronauts and scientists alike

In a craft like this, Man will go far into Space, on missions designed to let us know more about the planets which are our close neighbours in the vast solar system.

The assault on the Moon may be over but there's still plenty afoot in the world of Space for the rest of the decade. For a start, it's going to take that long for scientists to study the rocks and samples of lunar soil brought back by the crews of six Apollo moon landing missions.

The big event this decade is going to be the first launch of the Space Shuttle in late 1978 or early 1979. Can you imagine the sight at Pad 39, Cape Canaveral. A part-plane, part-rocket, part-spacecraft poised vertically on the pad like a jumbo-jet sitting on its tail. The biggest thing since the *Saturn 5*, and with more power.

When it has reached orbit, the Shuttle will have shed two of its rocket stages – which will have been recovered so that they can be used again – and with another big fuel tank attached to its belly, the airplane-like craft will perform pirouettes in Space as it goes through its paces.

By the 1980s these craft will be manned and will carry special Space labs into orbit. They will also conduct a multitude of other missions, such as in-orbit repair and collection of satellites. After the end of the missions they will be flown through the atmosphere and

VIKING TAKING SAMPLES FROM THE SURFACE OF MARS

The way Viking spacecraft will go on the hazardous journey to Mars, which at times is only 35 million miles from Earth.

piloted to conventional landings on airport landing strips. After being refurbished they will be ready for another of their 100 journeys from Pad 39.

Just why is the Shuttle the best thing to happen to Space since the inception of Project Apollo? It could save thousands of millions of pounds, that's why. Repairs could be affected by teams of specialists sent up in the Shuttle. The versatile craft could, by remote control, collect satellites and bring them back to Earth for repair, and then take them into Space again on the next available trip. They could even launch new satellites. Imagine putting a very expensive communications satellite into the cargo bay of the Shuttle, carrying it into orbit then deploying it in Space. Simple and cheap. It could mean the end of rockets as we know them for work such as this.

In addition, the Shuttle could start big planetary missions on their way. To get to Venus, for example, a probe must reach a speed of at least 25,000 mph; that is called escape velocity. To achieve orbit alone requires a speed of 18,000 mph. A space probe and rocket stage could be sent into orbit by the Shuttle and with more fuel available than normal, should rapidly achieve the extra 7,000 mph and might even increase the boost to, say, 35,000 mph, thereby allowing the probe to reach the target more quickly. The Shuttle could even take a whole rocket station into orbit, piece by piece.

The spacecraft of the future could help in another way, as you can read later.

A European Space Lab – manned one day by British scientist-spacemen – will be launched by the Shuttle. This should take place by the mid-1980s. In addition, Europe is building her own satellite launcher, the L3S. It should be making its first flight from South America in 1979.

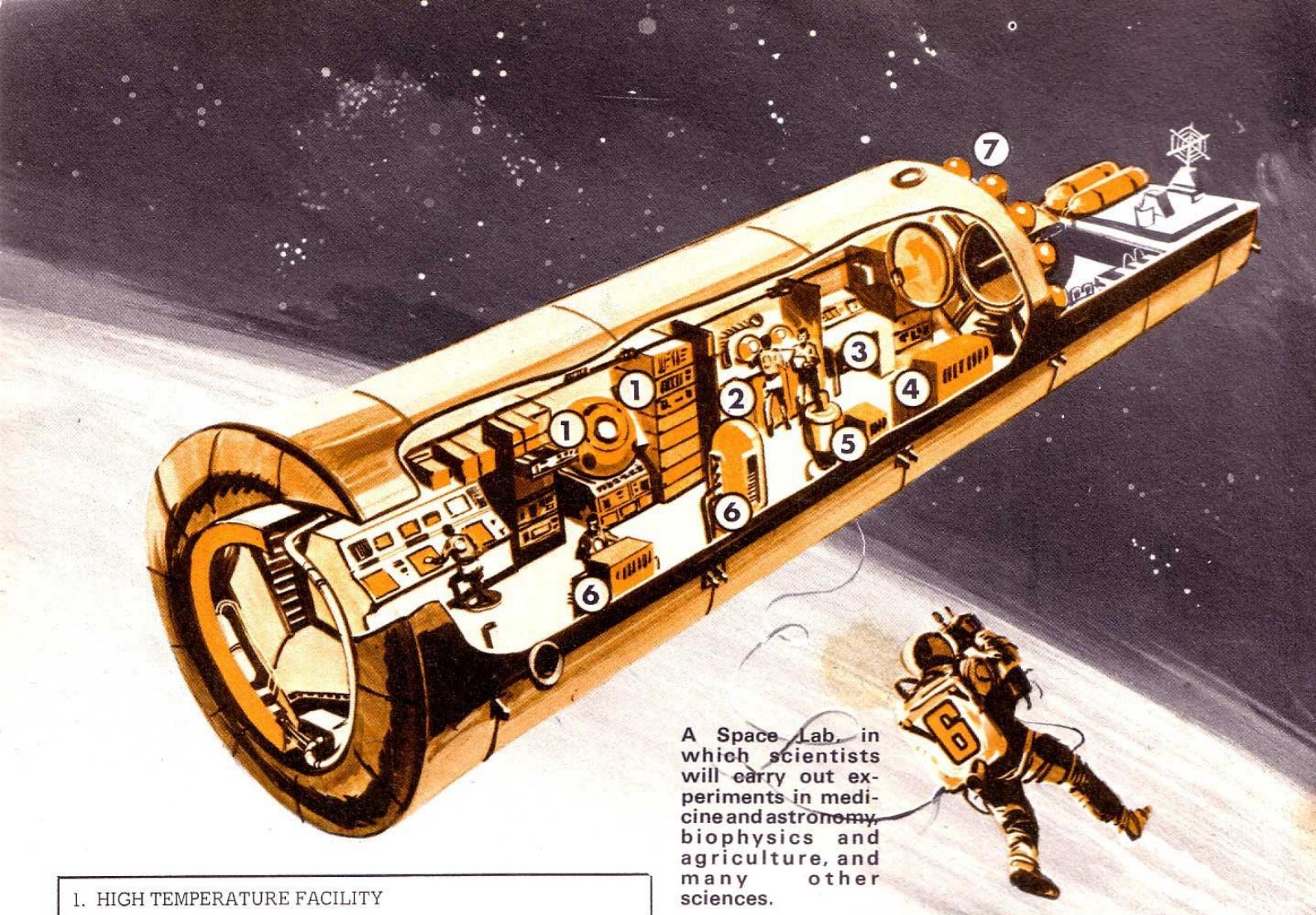
The year 1975 will see the landing on the planet Mars by two Viking spacecraft launched previously from the United States. These probes will take colour pictures of the surface and will analyse the soil for the detection of possible signs of life.

The two landing sites for the Viking Mars probes have already been chosen. They were selected after a thorough study of the spectacular pictures taken by the first probe to orbit Mars – *Mariner 9*.

A valley near the mouth of the 20,000-feet-deep Martian Grand Canyon has been chosen as the first site. The second will be about 1,000 miles north-east of the first. Both sites are fairly smooth and relatively calm areas in the planet's lowlands.

After a trip of some 240 million miles, the spacecraft will go into highly elliptical orbits, from which they will study the pre-selected sites in an attempt to certify that they are safe and scientifically attractive. Then each spacecraft will separate into two parts, an orbiter and a lander. Together, they will conduct studies of the Martian atmosphere and surface.

Each lander will carry a miniature laboratory which will analyse samples of the Martian soil for signs of life. A 10-foot retractable claw will be used to scoop the soil samples for analysis. Other instruments will analyse the atmosphere and measure pressure, temperature, wind velocity, composition of the soil, and quake activity. The data transmitted to Earth, either directly or via a relay link with the orbiter, will include panoramic, stereo, colour and infra-red pictures of the lander's immediate surroundings.



A Space Lab, in which scientists will carry out experiments in medicine and astronomy, biophysics and agriculture, and many other sciences.

1. HIGH TEMPERATURE FACILITY
2. MATERIAL ANALYSIS LABORATORY
3. FLUID CHEMICAL AND BIOLOGICAL FACILITY
4. INSTRUMENTATION AND CONTROL CENTRE
5. ENVIRONMENTAL CHAMBER A, WITH INSTALLED FURNACE
6. ENVIRONMENTAL CHAMBER C, WITH POWER UNIT
7. GAS BOTTLES

Below: **An artist's impression of a Space Station in which twelve men would carry out various tasks while orbiting Mars. But whether such a vehicle will ever make its way into Space seems doubtful.**

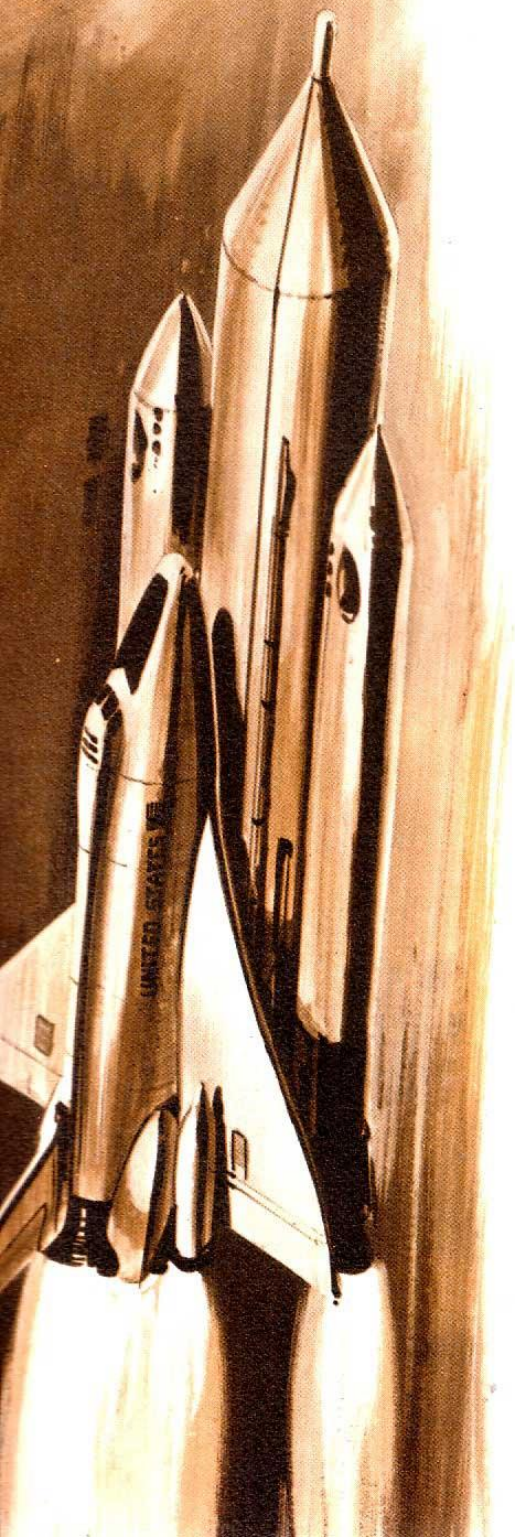
July 1975 will see a glorified Space summit meeting by five men – three US astronauts and two Russian cosmonauts. They will be flying *Apollo* and *Soyuz* spacecraft. To start the mission, Alexei Leonov – the first man to walk in Space, in March 1965 – and his co-pilot, scientist Valeri Kubasov – who flew aboard *Soyuz 6* – will be orbited around the Earth. About seven hours later – if all goes well – a *Saturn 1B* rocket will lift off from its launch pedestal on Pad 39B carrying an *Apollo* craft with Tom Stafford, Deke Slayton and Vance Brand aboard. Stafford will be making his fourth flight, after excursions into Space on *Gemini*'s *6* and *9* and *Apollo 10*, while Deke Slayton will be making his first flight after training since 1959! Brand will also be making his first flight.

The two crews will then dock and conduct two days of experiments. This flight will be the only one in the *Apollo-Soyuz* Test Project (ASTP), and one of its major objectives will be the development of a compatible docking system which will enable rescue missions to take place in future Space probes should the need arise.

The development of a 12-man cylindrical Space station to be launched by the US is in doubt. The shortage of money and the development of the Shuttle has slowed plans, but events can change quickly in the world of Space.

Instead of building a special Space station, scientists will kit out the 18-metres-long cargo bay of the Shuttle to carry out scientific missions. They will fly into orbit in the passenger compartment, then once safely in Space will transfer into the Space lab to work. They will undertake experiments in medicine, metallurgy, astronomy, biochemistry, biophysics, agriculture,

A Space Shuttle lift-off. When in Space, the Shuttle could be used in all kinds of activities, including the launching and recovery of satellites. At the top, we see the Shuttle's cargo doors open and manipulating arms being extended.



ecology and many other sciences. Experiments which have been suggested so far range from synthesising organic molecules in Space to search for new energy sources which might transform life on Earth.

In December 1973 the unmanned spacecraft *Pioneer 10* photographed Mars as it hurtled past on its way into Outer Space.

It is hoped that by the middle of 1975, *Pioneer 11* will have discovered more facts about the giant planet Jupiter, and then sped on towards a rendezvous with the tantalising rings of Saturn.

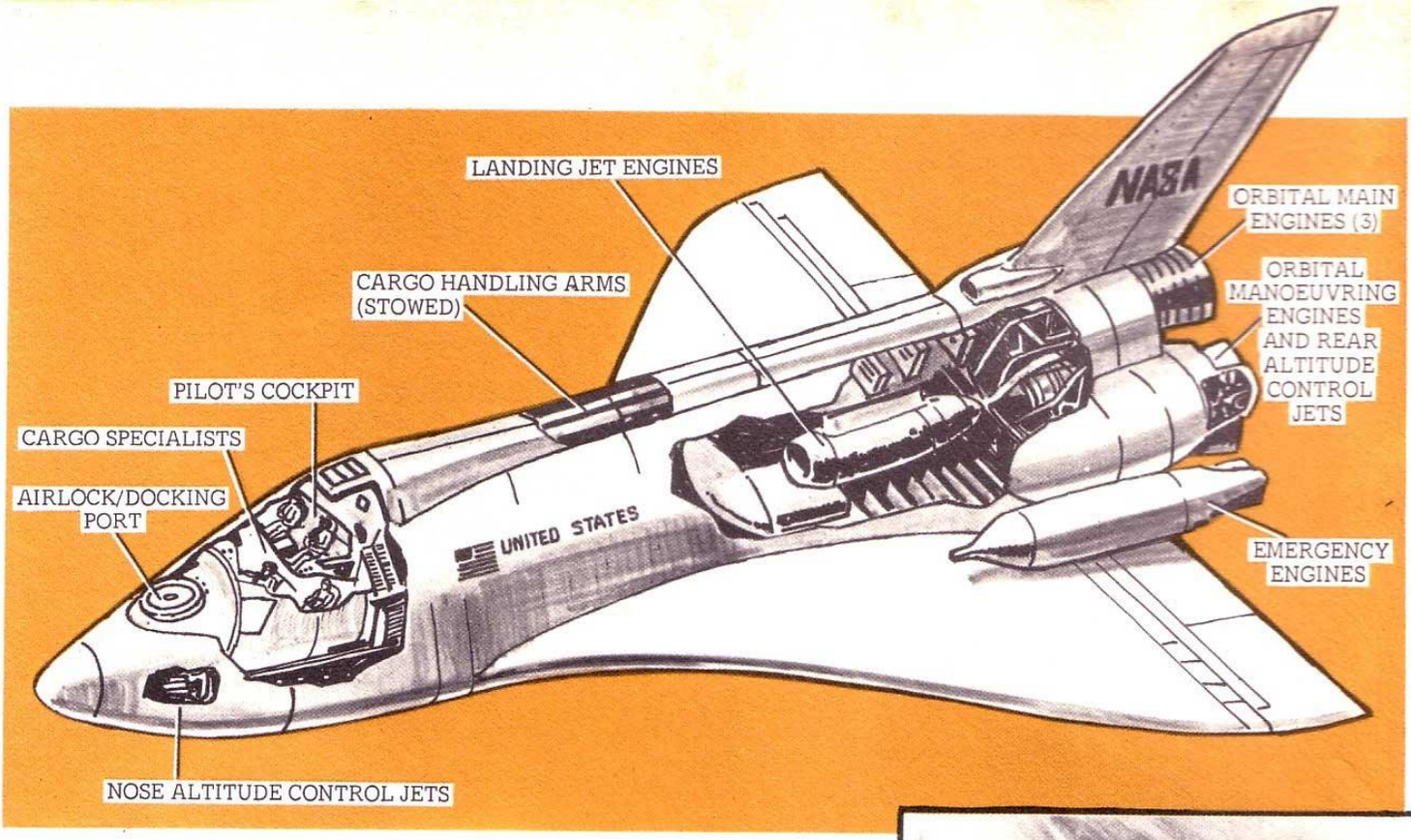
About six years after this Saturn adventure, *Pioneer 11* will, like its predecessor *Pioneer 10,* reach beyond the outer planet Pluto and speed on out of the solar system and into the Universe. In 100 million years from now it may still be travelling away from the Earth! On the off-chance that somewhere along the way it is intercepted by intelligent, scientifically-educated beings, *Pioneer* has been fitted with a plaque that would tell a distant mathematician from whence the spacecraft had come. The plaque is also illustrated with the figures of a man and woman drawn to scale against an outline of the spacecraft. The man has his right hand raised in greeting. There are no words on the plaque, but a pattern of lines has been drawn beside the human beings to represent the Milky Way – our own galaxy of stars of which our Sun is one.

What else is in store? Well, the launching of a second satellite to aid the study of Earth's environment; the orbiting of a communications satellite half the size of a house; a *Mariner* probe to fly to Jupiter and Saturn in the path of the *Pioneers* a satellite to aid navigation on the high seas; a British communications satellite; a probe to orbit Venus and deposit on its surface four special probes; spacecraft that will fly alongside comets; a satellite to study the oceans; and many, many more exciting missions.

It's difficult to predict what the Russians will be doing, but it is likely that they will send up big Space stations and launch many probes to the planets. Many opportunities exist for such flights in our solar system. As the Russians have previously taken advantage of such events, there is no reason to doubt that they will not take advantage of them. Between the 27th May and 20th June, 1975, the Russians could launch probes to Mercury and Venus. Perhaps by Christmas of that year we will see a Mercury Roving Vehicle.

Man could be walking on Mars by 1986 if either the United States or the Soviet Union take the decision to launch such expeditions. Perhaps as a result of the 1975 ASTP flight a joint mission will take place.

This is how the mission would go: Earth orbit: 5th April, 1985. Depart: The route takes the astronauts first to Venus, which they see on 10th September, 1985. The gravitational pull of the planet gives the Mars ship a critical and extremely valuable boost. The craft reaches Mars on 10th April, 1986. Human footsteps on the Martian surface could be a reality during



that month. After 40 days on or above the surface, the crew leave Mars in May and on 15th November – after a 590-day voyage in Space – the return to Earth's orbit to be collected by the "old-reliable" Space taxi, the Shuttle. It was the Shuttle that helped put the expedition together in Space, thus saving precious fuel required to reach orbit.

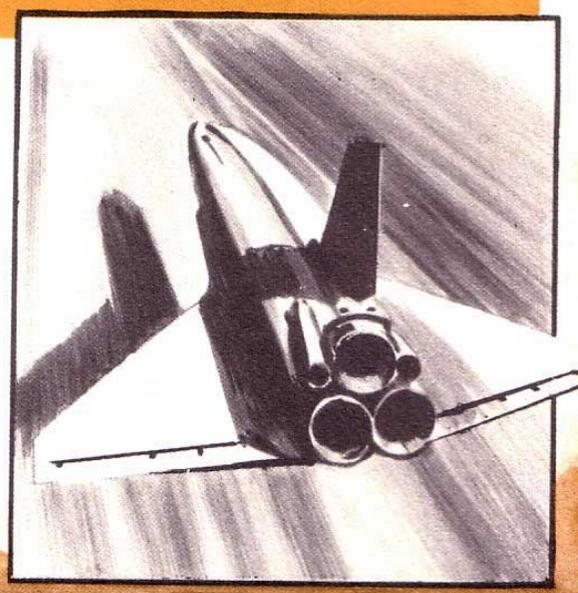
But that is looking far ahead. Let's deal now with a year much closer.

In 1977 it will be possible to launch a Space probe on a massive mission past the planets Jupiter, Saturn, Uranus and Neptune, using what is called the gravity assist technique. Basically, this means that a probe can take advantage of the gravity of one planet to enable it to deviate its normal path and make for the next stop in the solar system. In the following year another opportunity exists for such a flight.

A grand tour of the planets Jupiter, Saturn and Pluto is possible in 1977 and 1978. At least, the missions could start in those years. The actual journey would take years, of course. The planet Uranus could be surveyed by probes launched in 1977 and 1978.

The world of Space is going to be very busy in the next ten years. Its got an exciting future.

A Space Shuttle is much like an ordinary aircraft, and effects a landing in much the same way, as we can see on the right.



Not Martians on Earth, but Earthmen on Mars - a vision of the future.

ANSWERS TO 'GO ON, JUST HAVE A GUESS !'

(A) Dromedary. (B) Chimpanzee. (C) Sea Lion. (D) White Rhinoceros. (E) Lion. (F) Tiger. (G) Zebra. (H) Deer. (J) Polar Bear. (K) Elephant. (L) Jersey Cow.

HOVERPORT OF THE FUTURE

This is the design for a future Hoverport for a cross-channel car and passenger link by SR.N4 Hovercraft.

The existing forms of cross-channel transport by ship and aircraft would continue to carry the growth of traffic expected by the year 2,000. Beyond this level the hovercraft service could cater for a peak August daily traffic of 13,500 cars with a fleet of 16 SR.N4-type hovercraft by 1985.

Opening up the hovercraft routes across the Channel would avoid the congestion of traffic in the Dover-Calais areas.

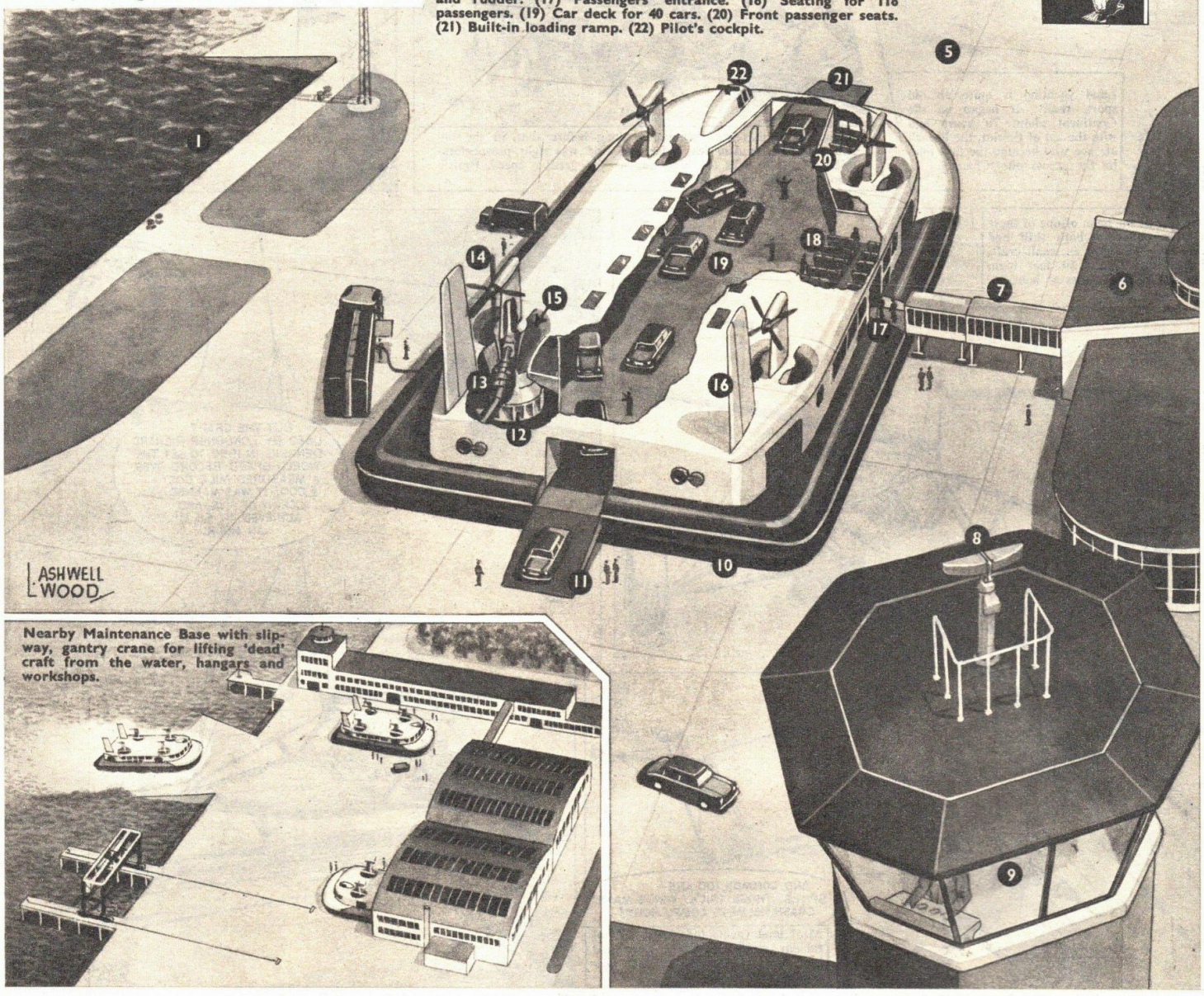
The projected hovercraft will travel at 77 knots in calm seas, down to 50 knots even in 6 to 8 ft. waves. They will weigh 170 tons and carry a load of 75 tons – 660 passengers (seated) or 116 passengers and 40 cars.

Four Bristol Siddeley Proteus gas-turbine engines, with totalling 14,000 h.p., will provide the lifting power and forward speed. Length – 128 ft. Beam – 83 ft.

KEY TO NUMBERED PARTS

(1) Hovercraft mooring bay. (2) Slipway (at high tide). (3) Floodlights. (4) Car and freight terminal. (5) Apron manoeuvring space. (6) Passenger concourse and restaurant. (7) Passenger gangway. (8) Radar scanner. (9) Control tower. (10) Lifting skirt. (11) Built-in unloading ramp. (12) Lifting air fan. (13) One of four Bristol Siddeley Proteus gas-turbine engines – 3,500 h.p. each. (14) Reversible pitch propellers. (15) Air inlets to lift fans. (16) Vertical fin and rudder. (17) Passengers' entrance. (18) Seating for 116 passengers. (19) Car deck for 40 cars. (20) Front passenger seats. (21) Built-in loading ramp. (22) Pilot's cockpit.

AN EAGLE *cutaway* DRAWING



Nearby Maintenance Base with slipway, gantry crane for lifting 'dead' craft from the water, hangars and workshops.

BATTLE WITH THE SWAMP-MONSTER! PAGE 10 PIRATES OF TODAY! PAGE 16

EAGLE and SWIFT
8 August 1964 Vol. 15 No. 32
EVERY WEDNESDAY 6d.

DAN DARE
Pilot of the Future
in ALL TREENS MUST DIE!

The Mekon, a creature of terrible evil, had returned to Venus with a few of his Treen followers. He was attacking the capital, Mekonta, which was now ruled by President Sondar, a friendly Treen and Earth's ally. A strange light was impelling many Treens to enter Lake Mekonta. Dan tried to stop them with a nerve gun, but it blew up!

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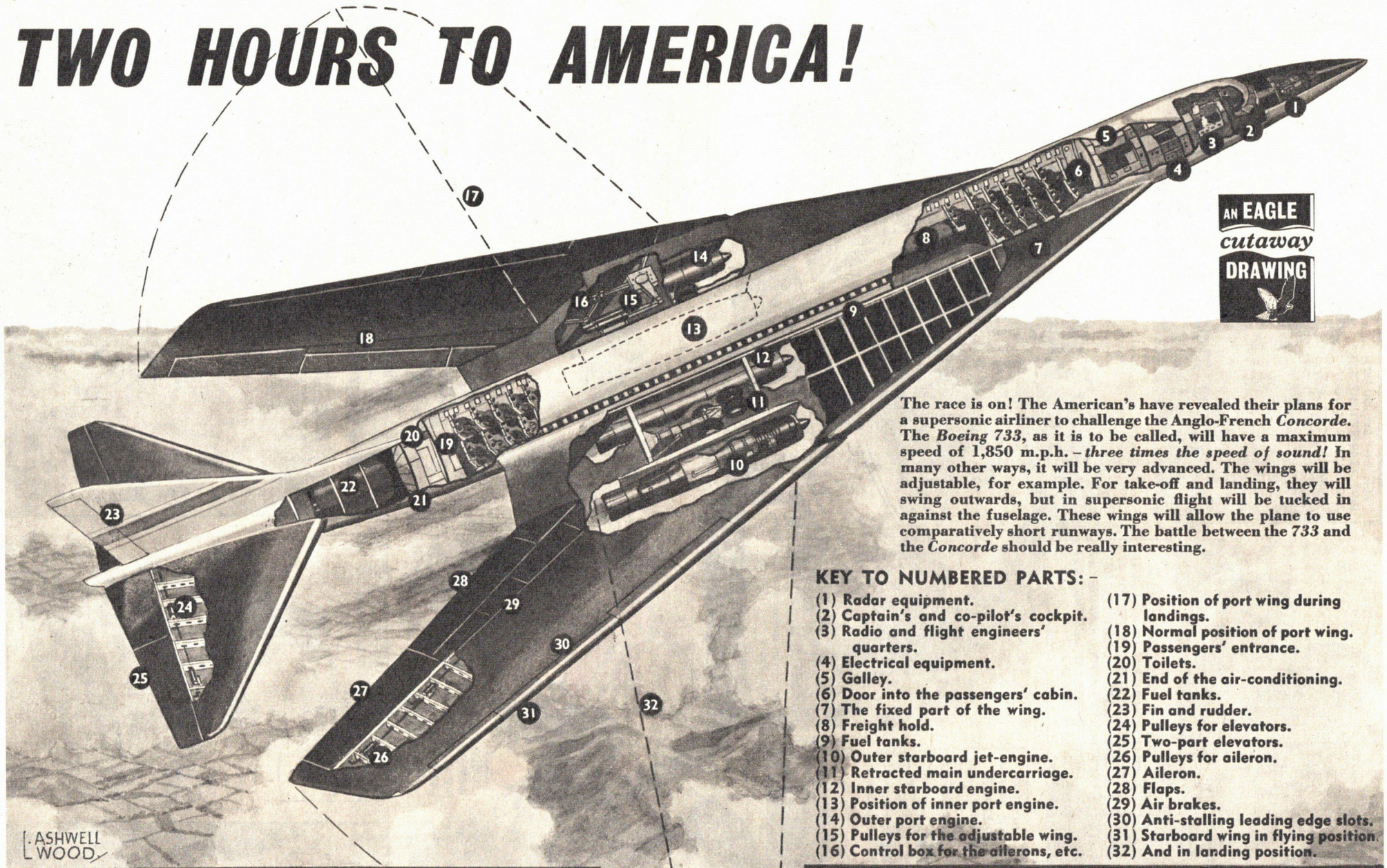
CONTINUED ON BACK PAGE

TWO HOURS TO AMERICA!

AN EAGLE *cutaway* DRAWING



L. ASHWELL WOOD

The race is on! The American's have revealed their plans for a supersonic airliner to challenge the Anglo-French *Concorde*. The *Boeing 733*, as it is to be called, will have a maximum speed of 1,850 m.p.h. – *three times the speed of sound!* In many other ways, it will be very advanced. The wings will be adjustable, for example. For take-off and landing, they will swing outwards, but in supersonic flight will be tucked in against the fuselage. These wings will allow the plane to use comparatively short runways. The battle between the *733* and the *Concorde* should be really interesting.

KEY TO NUMBERED PARTS: –

(1) Radar equipment.
(2) Captain's and co-pilot's cockpit.
(3) Radio and flight engineers' quarters.
(4) Electrical equipment.
(5) Galley.
(6) Door into the passengers' cabin.
(7) The fixed part of the wing.
(8) Freight hold.
(9) Fuel tanks.
(10) Outer starboard jet-engine.
(11) Retracted main undercarriage.
(12) Inner starboard engine.
(13) Position of inner port engine.
(14) Outer port engine.
(15) Pulleys for the adjustable wing.
(16) Control box for the ailerons, etc.
(17) Position of port wing during landings.
(18) Normal position of port wing.
(19) Passengers' entrance.
(20) Toilets.
(21) End of the air-conditioning.
(22) Fuel tanks.
(23) Fin and rudder.
(24) Pulleys for elevators.
(25) Two-part elevators.
(26) Pulleys for aileron.
(27) Aileron.
(28) Flaps.
(29) Air brakes.
(30) Anti-stalling leading edge slots.
(31) Starboard wing in flying position.
(32) And in landing position.

The American *Boeing 733*. The *Boeing* is to have a top speed of 1,850 m.p.h., and will have a passenger capacity of 150 to 227.

The Anglo-French *Concorde* – rival to the *Boeing*. The *Concorde* will have a top speed of 1,450 m.p.h., and will carry 106 passengers. New plans are being made up to make the *Concorde* as fast as the *Boeing*.

FABULOUS FREE PRIZES TO BE WON INSIDE!

EAGLE

and BOYS' WORLD

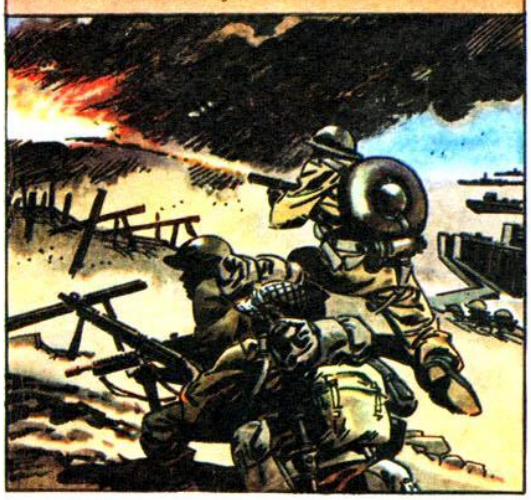
7d 13 November 1965
Vol. 16 No. 46
EVERY WEDNESDAY

You can . . . Drive a Tank . . . Take a ride in a Hovercraft . . . Have a flight in a glider . . . Spend a day with the Navy . . . Drive a loco simulator.

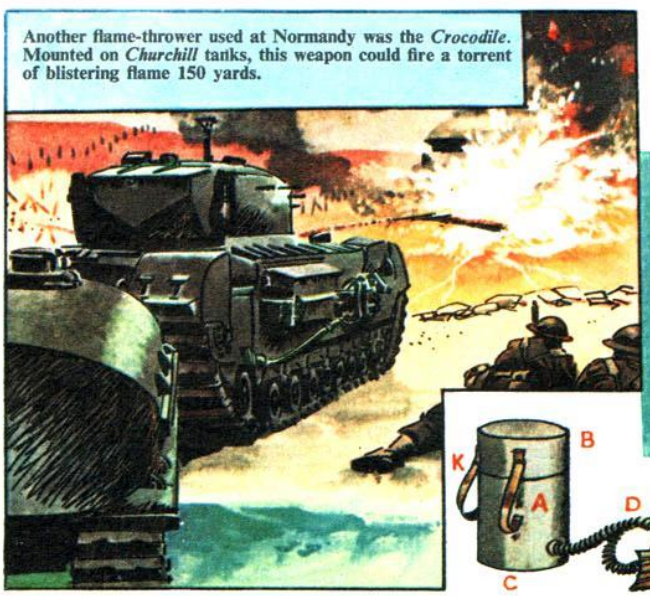
Turn to page 4 for more details of super prizes!

Crouching down in their trenches on the Ypres-Menin road, a small party of British infantrymen were desperately holding out against German attack. The date was July 30th, 1915. Without any warning, they were suddenly enveloped in sheets of searing flame. The Britons were the first victims of the new German terror weapon, the *Flammenwerfer* – or flame-thrower.

The Germans had more than a taste of their own medicine 29 years later, during the 1944 D-day landings. British troops were equipped with *Lifebuoy* flame-throwers – much deadlier than the old *Flammenwerfer*.



Another flame-thrower used at Normandy was the *Crocodile*. Mounted on *Churchill* tanks, this weapon could fire a torrent of blistering flame 150 yards.



ARMS THROUGH THE AGES

No. 16

THE FLAME-THROWER

The *Flammenwerfer* consisted of a steel cylinder (A), with high-pressure gas at the top (B) and oil at the bottom (C). The gas forced the oil through the hose (D), which led to a tube (E) mounted on a rifle butt (F). A trigger (G) controlled the flow of high-pressure oil which, when ignited, emerged as a flame (H) from the muzzle (I). A hand-grip (J) and shoulder straps (K) enabled the weapon to be carried.

SEE PAGE 19

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ALSO INSIDE—GREAT SPACE SUPPLEMENT!

GET GOING INTO SPACE

WITHIN the next five years, man will leave his home planet to set foot upon another world – the moon.

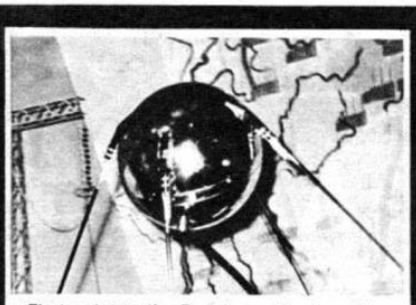
Soviet Russia took the first step in the great adventure on October 4th, 1957, when her space scientists put Sputnik 1 into an orbit round the earth. A month later, on November 3rd, Sputnik II carried aloft the dog Laika – the first living thing from the earth to go into orbit.

America entered the space age on February 1, 1958, with Explorer 1, which discovered the Van Allen radiation belts. This was followed by Vanguard 1, which went into orbit on March 17, 1958, and is expected to continue circling the earth for 1,000 years. On September 13, 1959, the Russians hit the moon with Lunik II and on October 4 of the same year photographed its hidden side.

On April 12, 1961, Major Yuri Gagarin of the Russian Air Force became the first man in space by orbiting the earth in Vostok II. Three weeks later, astronaut Alan Shepard became the first American to enter space. On February 20, 1962, Colonel John Glenn orbited the earth three times in Friendship 7.

Three outstanding achievements took place this year. On March 18, Lt Col Alexei Leonov stepped into space 300 miles above the earth and 'swam' 3,000 miles in ten minutes attached to the two-man Coskhod II. On June 3, Major White of the U.S. Air Force space-walked for 14 minutes attached to Gemini IV sweeping at 17,500 miles an hour 150 miles above the Pacific. And on August 21, Gordon Cooper and Charles Conrad made their eight-day orbit of the earth.

Next step: The Moon.



First point to the Russians – the launching of Sputnik I on October 4th, 1957

Laika – the world's first space-dog – was sent up in Sputnik II a month later

On April 12th, 1961, Yuri Gagarin became the first man in space, orbiting the Earth in Vostok II

The Americans hotted up the space-race by sending up Alan Shepard three weeks later

On June 3rd this year, Major White of America stepped out of his Gemini craft for a 17,500 m.p.h. walk in space

J. Batchelor

OPERATION MOON!

When the United States Gemini V came back to Earth on August 29th, Lt.-Colonel Cooper and Lt.-Commander Charles Conrad had been orbiting for eight days. This is longer than it would take a spaceship to travel to the moon and back . . .

These drawings show how two objects in space are 'docked' or joined together, as in the present Gemini experiments. One of the most intricate manœuvres in astronautics, it needs fantastically accurate mathematics and navigation. Imagine that a Gemini manned capsule 'A' has to dock with an unmanned object 'B'. The crew in 'A' pick up 'B' on their radar at a distance of 250 miles, and their computer works out the point at which the two craft will meet. Guided by flashing beams on 'B', the crew of 'A' fire rockets to speed up their craft and it manœuvres its nose into 'B's' docking collar.

LABORATORY IN SPACE

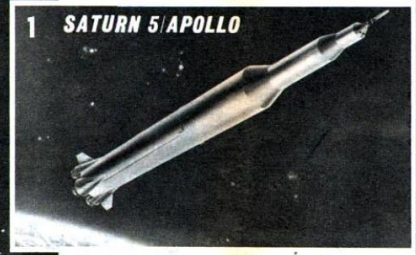
THE next step into space, which will take place in two or three years' time, is the Manned Orbiting Laboratory (M.O.L.) – seen on the right. It is an entirely new development in spacecraft. M.O.L. will be manned by a crew of two, who will remain on board for a month. They will then be relieved by two more men. The journey to the space laboratory will be made in a *Gemini* capsule sent into orbit by rocket from Cape Kennedy.

By means of steering rockets, M.O.L. and the *Gemini* capsule will manœuvre until they are able to join together. The relief crew will then transfer to the laboratory and the old crew will take their place in the capsule. The laboratory and the capsule will then separate and the latter will return to earth.

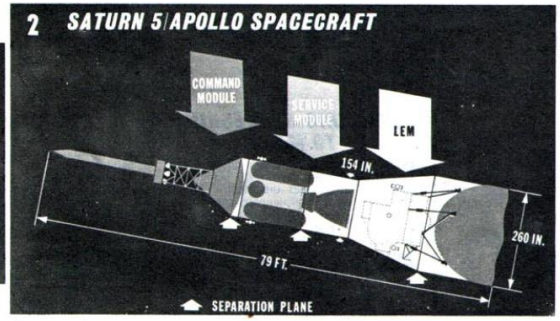
M.O.L. will be a cylinder 41 feet long and 10 feet in diameter and will be shot into space by a *Titan* rocket and will go into orbit between 200 and 300 miles above the earth. The laboratory will be on three 'floors': one for living quarters, one for the mass of scientific equipment, and the third for supplies. One great advantage of M.O.L. is that those on board will be able to move about inside without having to wear space-suits.

M.O.L. will also be provided with an air-lock so that one of the crew can don a space-suit and leave the laboratory to 'swim' in space.

1 SATURN 5/APOLLO



2 SATURN 5/APOLLO SPACECRAFT



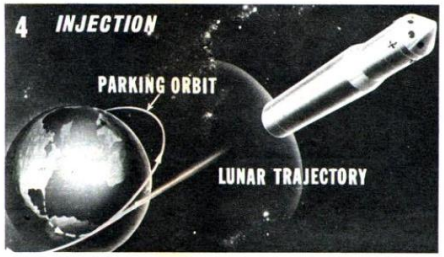
3 SATURN 5/APOLLO LOR MODE: LAUNCH-TO-INJECTION SEQUENCE

POWERED by its mighty *Saturn 5* rocket, the *Apollo* spaceship has blasted off its launching pad at Cape Kennedy on the 70-hour journey to the moon, 239,000 miles away. *Saturn* is 280 feet high and 33 feet in diameter, and consists of three separate rockets wrapped in one great stack.

The first section of *Saturn* consists of five rocket motors. On top of the first stage is a second stage, powered by five slightly smaller rocket engines. On top of these is the third stage, powered by a single engine that can be stopped and started instead of burning out in one great surge. On top of *Saturn* is the *Apollo* moon-ship itself (2), consisting of cockpit or 'command module' in which the three astronauts will ride. Below that is the 'service module' – a section containing fuel tanks, oxygen, supplies, cells to supply electricity, and a single rocket motor. Beneath the service module is the actual moon-landing vehicle, called L.E.M. (Lunar Excursion Module) or the 'Bug', which will land two astronauts on the moon and bring them back again. The entire assembly (*Apollo* and *Saturn*) is 359 feet long, and with its equipment and fuel weighs 3,000 tons. Attached to the extreme tip of the crew cabin is an escape tower which can be blasted off the main assembly to bring the astronauts back to Earth in the event of anything going wrong during the early part of the flight.

The first stage of the *Saturn 5* rocket blasts the moon-craft up to 40 miles and then falls away.

4 INJECTION

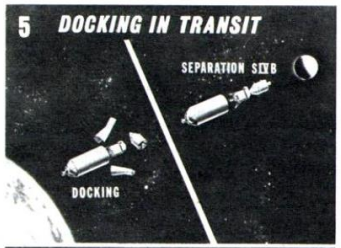


The second stage then ignites and blasts the moon-ship a further 60 miles, after which the second stage and escape tower fall away. The third stage fires briefly and puts the moon-ship into an orbit round the earth (see pic 3).

The third stage of *Saturn* with the moon-ship attached, remains parked in its orbit round the earth (4), while the crew wait instructions from the ground control-station as to the course they must set for the moon. Immediately they receive their orders, the astronauts start up *Saturn's* third-stage motor and set off on the trajectory or curved course for the moon (see above). The front part of the moon-ship, consisting of the crew cabin and the service module, separates from *Saturn's* third stage and the landing *Bug* (5), turns completely round by means of side-firing rockets and then joins up again. This is a 'docking' manœuvre, mentioned earlier, and is one of the most difficult parts of the astronauts' journey. Now the capsule is 'nose on' to the *Bug*. When the cabin and service module have linked up with the *Bug*, the *Saturn's* third-stage motor is started up and gives the moon-ship a final thrust. It then separates and falls away, as on the right of picture 5. The moon-ship now continues its journey with the *Bug* at the rear. It does not need any rocket-power at this stage as it is coasting towards the moon by force of gravity. When the *Apollo* assembly comes within 60 miles of the moon, it goes into orbit around it (6). As the ship circles the moon, two of the astronauts climb into the *Bug* and check their landing position.

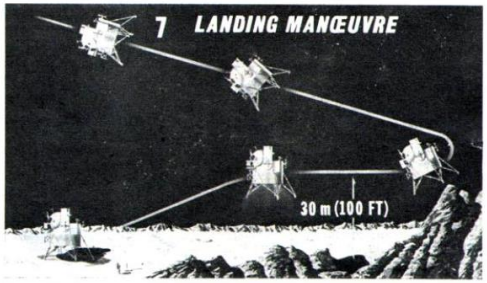
When the landing site has been fixed, the *Bug*, with the two astronauts on board, separates from the cabin and service module and descends towards the moon, leaving the other section of the spaceship with its one-man crew in orbit round the moon. As the *Bug* descends (7), it fires rockets from its base to slow down the rate of fall. When within 100 feet of the moon surface, the landing vehicle uses rockets to hover for a few minutes – allowing the astronauts to make certain that it is safe to land. At this point, the crew can rocket their ship back to the parent craft, should they consider it unsafe to land. If all is well, however, the rocket power is reduced and the *Bug* touches down on its tripod legs. The door opens and the astronauts step out. Their 70-hour journey of 239,000 miles is over, and they are the first men on the moon.

5 DOCKING IN TRANSIT



6 ENTERING LUNAR ORBIT

7 LANDING MANŒUVRE



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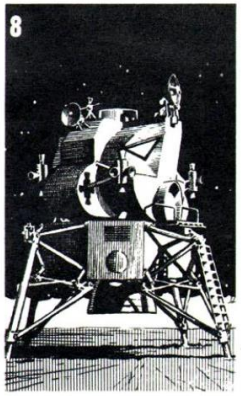
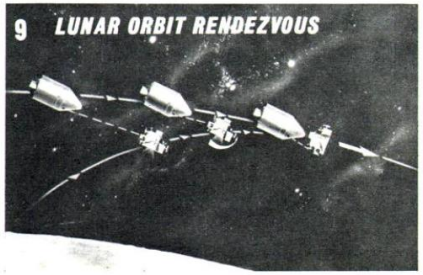


The lunar explorers will spend a day or more on the strange new world, collecting rock samples, taking photographs, examining the ground and moonscape, and carrying out other scientific work. They will radio reports of their discoveries back to earth, which will be clearly visible to them. They will then return to their cabin on top of the *Bug* and start up a rocket motor. This will lift them off the moon to rendezvous with the mother craft still in orbit. The four-legged descent segment, which also served as a launching pad, is left behind (8). As the mother craft spins in orbit round the moon, the landing-craft soars up to meet it (9), and the two craft manœuvre with their steering rockets until they are able to join together again. When that has been done, the two astronauts pass from their landing vehicle into the cabin of the main ship. The *Bug* or Lunar Excursions Module is then released from *Apollo* and left circling the moon in orbit (10). A rocket with a thrust of 22,000 pounds on *Apollo* is started up and boosts the spaceship out of its lunar orbit on to a course for the return to Earth. A critical part of the return journey is the re-entry into Earth's atmosphere. While hurtling at 25,000 miles an hour, the *Apollo* crew must use their steering rockets to guide their craft into a relatively tiny corridor in the immensity of Earth's atmosphere. If they aim too high, the ship will hurtle past the Earth and career off non-stop into space. If they aim too low, the force of the Earth's gravity will build up to 250 times the force of gravity and crush the moon-ship and crew. The accuracy needed to navigate the moon-ship into the correct return corridor can be compared to trying to shoot the fluff off a tennis ball, without hitting the ball, from a distance of 100 yards. The service module of *Apollo*, with its rocket motor, will be used for propulsion and manœuvre until the astronauts are in the correct return corridor. The command module turns over so that its nose points away from the Earth (11). This module will be subjected to extreme stresses and searing heat as the atmosphere slows down its headlong flight to earth (12). Flame envelops the craft as the heat shield covering its outer surface melts and vaporizes at a temperature of 1,500 degrees centigrade. But the crew is safe inside throughout the fireball descent as the commander manœuvres with his steering rockets to keep on course.

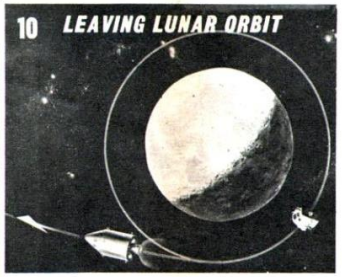
At a height of 60,000 feet from the Earth's surface, a small parachute called a 'drogue' will open and steady the craft. When the module is within 10,000 feet of the Earth, the three main parachutes will billow out and gently lower the cone-shaped command module on to its predetermined landing site (13). The doors open, and the three intrepid astronauts are back in this world again – the first men to journey to the moon and back.

The round trip will have cost 3,000 million dollars, and the 20,000 firms that made components for the space flight employed 300,000 workers.

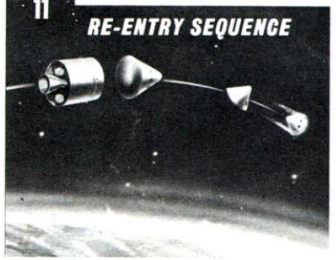
9 LUNAR ORBIT RENDEZVOUS



10 LEAVING LUNAR ORBIT



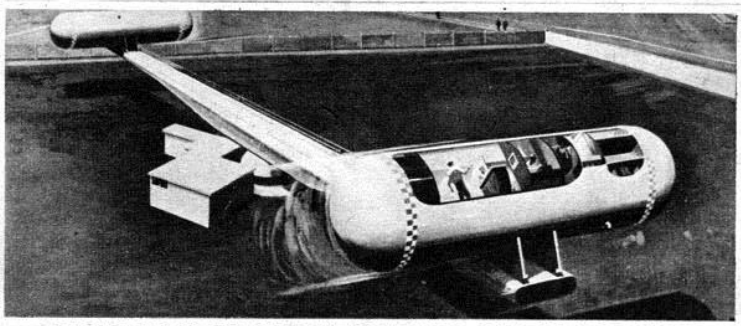
11 RE-ENTRY SEQUENCE



12 RE-ENTRY

13 DESCENT

STEPPING STONES TO THE PLANETS



SPACEMEN WITH THEIR FEET ON THE GROUND

WHEN the first manned spaceship sets out on its journey to the moon, the crew will be thoroughly accustomed to weightlessness and the other 'unearthly' conditions they must encounter. And they will have got all their information before they leave the ground.

Full-scale models of the spaceship have been built in which the crews will experience all the conditions of outer space – on land. The models are mounted one at each end of a massive steel girder 150 feet long, through the centre of which the spindle rotates driven by a powerful electric motor. The speed at which the spindle rotates can be varied, and there are devices to simulate wobble, tilt and other space conditions, including weightlessness.

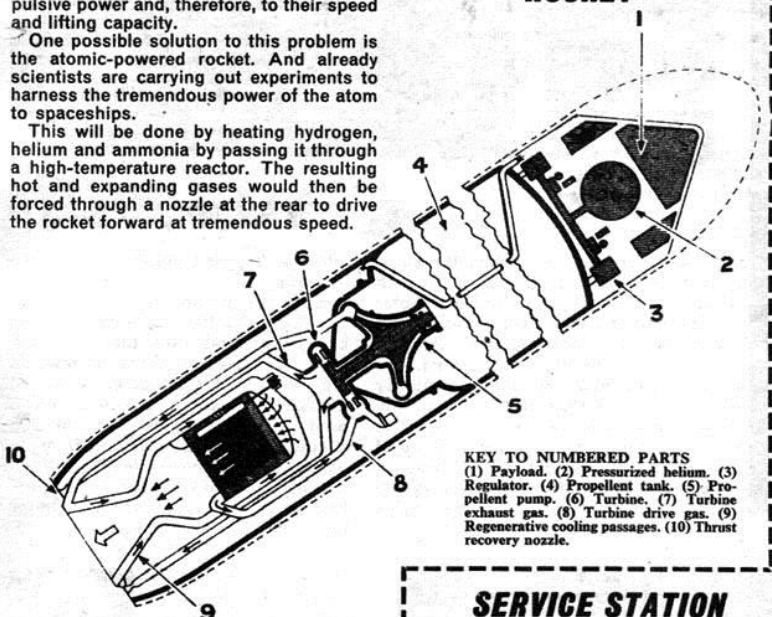
Each of the land spaceships consists of a cylinder-shaped capsule 40 feet long and 10 feet in diameter. It contains laboratory, kitchen, bathroom and sleeping quarters for four men. Crews will be locked up in the spinning capsules for periods of 30 days.

ATOM-POWERED ROCKET

ONE of the disadvantages of space rockets burning solid or liquid chemical fuels is that there is a limit to their thrust or propulsive power and, therefore, to their speed and lifting capacity.

One possible solution to this problem is the atomic-powered rocket. And already scientists are carrying out experiments to harness the tremendous power of the atom to spaceships.

This will be done by heating hydrogen, helium and ammonia by passing it through a high-temperature reactor. The resulting hot and expanding gases would then be forced through a nozzle at the rear to drive the rocket forward at tremendous speed.



KEY TO NUMBERED PARTS
(1) Payload. (2) Pressurized helium. (3) Regulator. (4) Propellent tank. (5) Propellent pump. (6) Turbine. (7) Turbine exhaust gas. (8) Turbine drive gas. (9) Regenerative cooling passages. (10) Thrust recovery nozzle.

Some of the gas issuing from the nozzle would be recovered and pumped back to the reactor for heating. In this way, the fuel could be used over and over again, so doing away with the enormous tanks needed for ordinary rockets.

Another suggestion is a rocket using nuclear fusion. To do this, light atomic nuclei would be fused together to form heavier nuclei. That is what is already being done in the sun, which is constantly turning hydrogen into helium.

The great problem that has to be solved before a nuclear-fusion rocket becomes possible is to find some way of dealing with the tremendously hot gases created by atomic fusion.

Whatever type of nuclear rocket eventually may be built, it could not be used for directly blasting a spaceship off its launching pad.

Because of the deadly radiation from the gases that would stream from the nozzles, the atomic-powered spaceship would be lifted off the ground by an ordinary rocket using liquid or solid chemical fuel. Then, when the spaceship was several hundreds of miles above the earth, the chemical rocket would fall away and the atomic rocket take-over after there was no risk of the radiation reaching the earth.

ELECTRIC SPACESHIP TO MARS

RECENT tests with scale models of ion engines have convinced America's space scientists that the electric rocket holds the key to interplanetary travel.

According to the United States National Aeronautics and Space Administration, American astronauts will, within the next 20 years, be able to travel to Mars and back in an electrically-propelled spaceship powered by a cluster of ion engines.

Unlike the ordinary rocket motor, the ion engine does not burn liquid or solid fuel. Instead, it produces rocket thrust by creating and accelerating charged particles called ions.

The actual power source of the engine is a small atomic reactor that converts nuclear energy into electricity. Reactors of this type have already been used to provide power for satellites put into orbit to collect weather information.

The electricity produced by an ion-engine reactor heats a tungsten element which comes into contact with caesium vapour, thus removing the negatively-charged electrons and leaving positively-charged particles – the ions. These particles then form what is called an ionized gas.

GREATER SPEED

The resulting ion beam or electrified gas rushes from exhausts at the rear of the engine. The speed and energy of the ion beams is much greater than those of the burning gases that issue from a rocket using liquid or solid chemical fuels.

Present plans are to use the ordinary chemical-fuel rocket to provide the take-off boost. When the spaceship has been carried through the dense atmosphere surrounding the earth, the chemical rocket will fall away. The ion engines will then take over to propel the spaceship at high speed and for long periods through the frictionless vacuum of space.

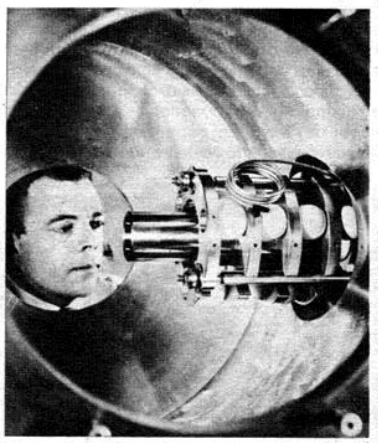
Although the thrust of an ion rocket is comparatively small, it can operate for a very long time on very little fuel. An ion motor will be able to provide continuous thrust for months compared to minutes for chemical fuel rockets.

It has been estimated that an ion engine with a thrust of only one pound would propel a 5,000-pound spaceship at a speed of 15 miles an hour after the first 60 minutes of being switched on.

Thereafter, the movement of the ion stream increases very rapidly. By the end of 24 hours the speed of the spaceship would increase to 375 miles an hour, and, at the end of 30 days, an ion-powered spaceship would be travelling at 11,000 miles an hour.

One of the great advantages of the ion engine is that the speed at which it propels the spaceship can be increased or decreased simply by moving a lever. For example, an ion rocket propelling a spaceship to, for example, Mars, would make the greater part of the journey at a speed of thousands of miles an hour. Then, as the spaceship came near to its destination, the motor's speed would be reduced and the craft approach the planet at a few miles an hour.

The ion motor may even carry men to Pluto, the Sun's outermost planet and about 3,600 million miles from the earth.



A technician looks at a model ion-engine mounted in a test chamber

SERVICE STATION IN SPACE

BLASTING a spaceship off the earth to carry men to Mars, Venus or any other planets of our solar system requires a tremendously big and powerful rocket to lift the craft free of the earth's gravity. And by far the greater part of the rocket power will be used to get the spaceship on the first hundred miles of its journey.

Consequently, some space scientists believe that the cheapest and most efficient springboard to the planets will be a permanent workshop and filling-station in space. This will consist of a number of separate compartments fixed by spokes to a central body.

The whole assembly will be put together in space at a height of about 800 miles above the earth, where there is practically no force of gravity. The parts will be sent into orbit by comparatively small rockets and assembled by engineers wearing spacesuits and 'walking' in space. They will be able to move about by using small rocket motors.

As the parts arrive in orbit, they will remain there until pushed into position as the space station takes shape. There will be no difficulty in moving the parts, as the lack of gravity will make them practically weightless.

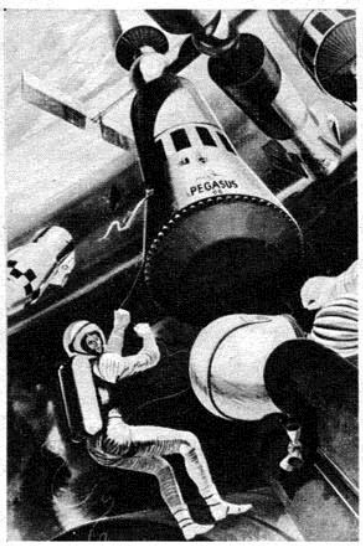
When the space station is completed, it will contain workshops and living quarters for the engineers who will service and fuel the spaceships bound for interplanetary journeys. The spaceship itself will need only sufficient rocket power to reach the space station.

There its blast-off rocket will be removed and the less powerful rockets needed for the distant journey into space will be fitted and fuelled. The central portion of the space station will have a dock in which this can be done.

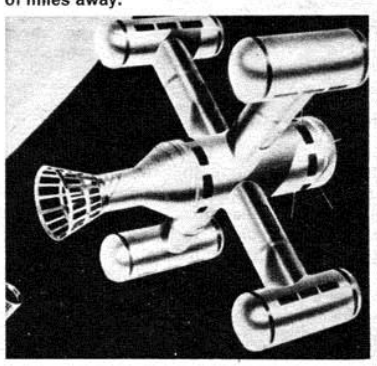
Because of the height at which it will orbit the earth, the space station will be beyond the earth's gravity. Normally, this would make the work of the station's crew very difficult, but it will be overcome by fitting to it comparatively low-powered rocket motors which will set it spinning on its axis.

As a result there will be an artificial gravity within the space craft enabling the crew to work and move about as they would on land.

Besides workshops, fuel tanks and pumps for servicing the spaceships using the docking bay, the orbiting service-station will have laboratories and equipment where scientists can study conditions existing hundreds of miles above the earth. There will be a weather reporting station, an astronomical observatory, and radio and television transmitters and receivers to maintain contact with spaceships millions of miles away.



Engineers wearing small rocket motors will assemble the parts of the space station



SCHOOL FOR RACING DRIVERS . . . Page 12.

UNDER-SEA AIRCRAFT . . . Page 13

EAGLE

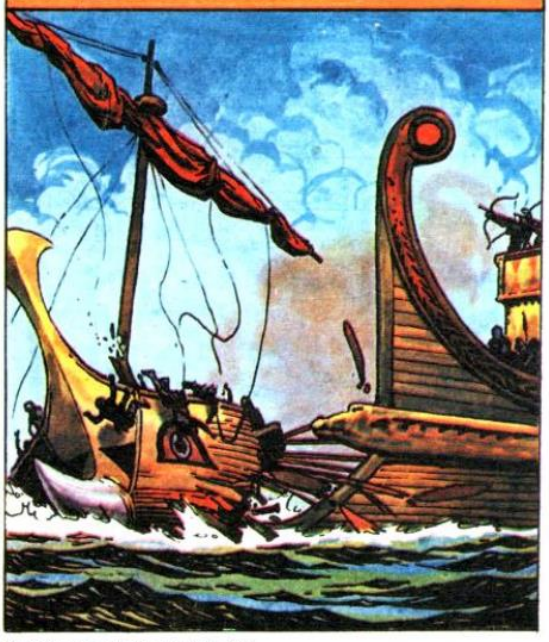
and BOYS' WORLD

7d 20 November 1965
Vol. 16 No. 47
EVERY WEDNESDAY

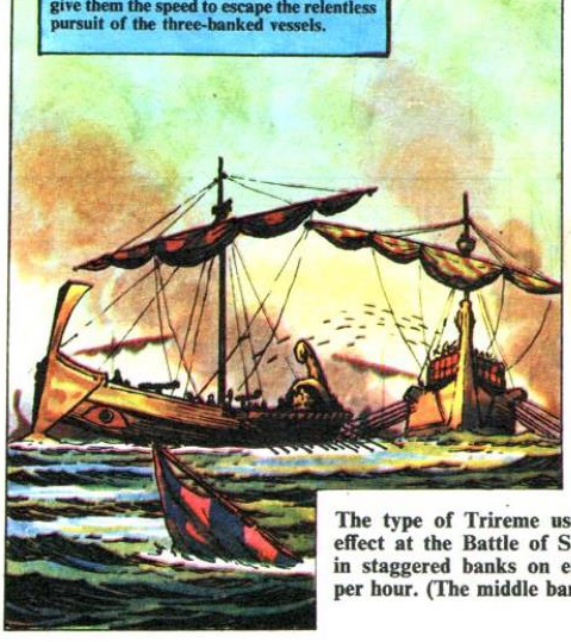
With their crews sweating at the oars on that hot September day of 480 B.C., the new Greek *Triremes* annihilated the great Persian fleet in the bay of Salamis. This shattering naval victory made Greece mistress of the Mediterranean.

ARMS THROUGH THE AGES

Ship after ship in the Persian fleet was torn to matchwood by the spike-like rams mounted under the bows of the *Triremes*.



Most of the Persian ships were *Biremes*, and their double banks of oars could not give them the speed to escape the relentless pursuit of the three-banked vessels.



The type of Trireme used by the Athenians with such devastating effect at the Battle of Salamis was propelled by 160 oars arranged in staggered banks on either side, and had a top speed of 10 miles per hour. (The middle bank of oars being pivoted on the gunwhale.)

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AIRCRAFT WHICH GOES UNDER THE SEA!

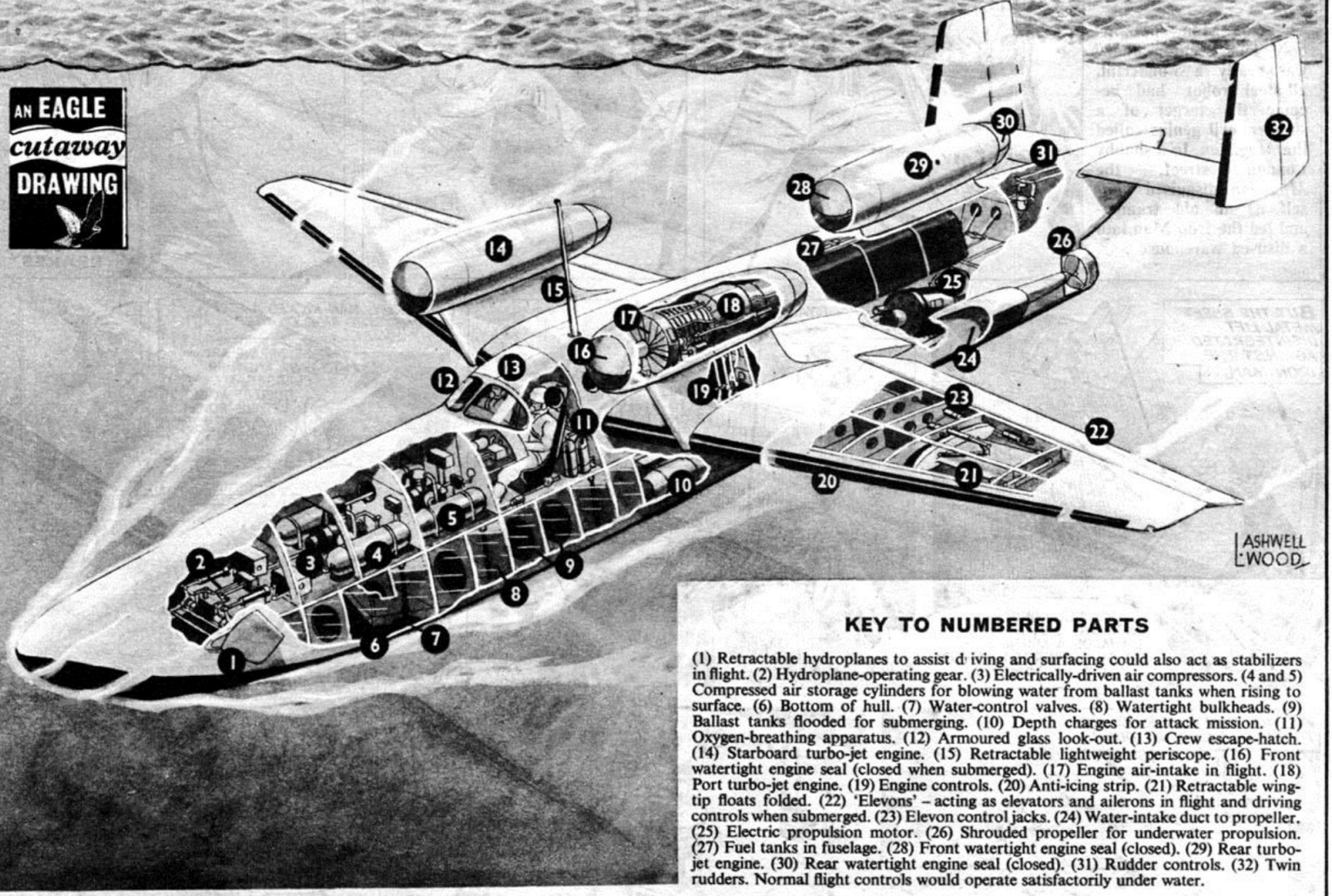
AFTER six months' study, the General Dynamics/Convair Company of the United States have said they are quite capable of building a flying boat that could travel through the air and *under* the sea. This fantastic machine, called a Sub-Plane, may become a real-life version of the TV 'Supercar'.

As the drawing shows, the Sub-Plane would be basically like a flying boat, with three turbo-jet engines mounted in pods above the wing and over the rear fuselage. In flight, the Sub-Plane would have a target range of nearly 600 miles at a speed of 260 m.p.h., with a half a ton payload.

Near the target, it would alight on the water. The pilot would make the jet engines watertight. Ballast tanks would be flooded and the Sub-Plane could sink to a depth of 75 feet, driven by an electric motor and batteries. The underwater speed would be five knots. The Sub-Plane's mission might be to attack enemy submarines or as a base for rescue or salvage work.

The Sub-Plane in flight and about to alight on the water as a flying boat, with retractable wing-tip floats extended

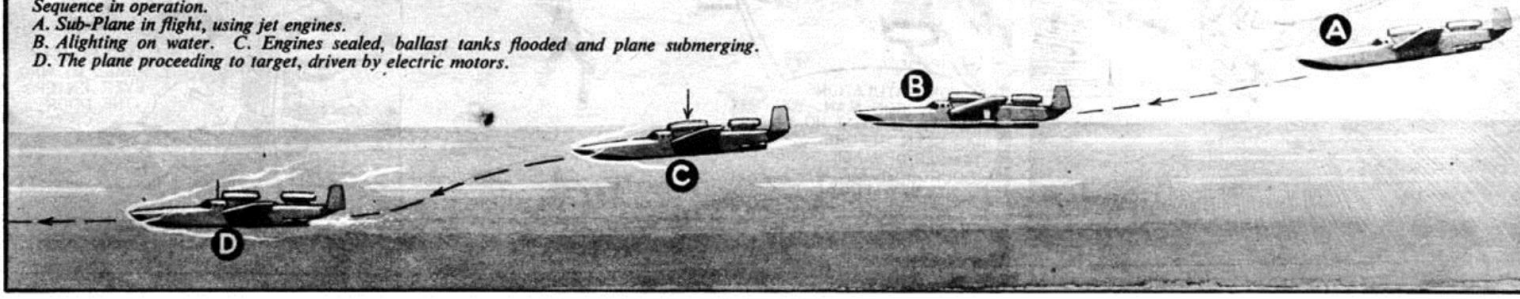
AN EAGLE *cutaway* DRAWING



KEY TO NUMBERED PARTS

(1) Retractable hydroplanes to assist diving and surfacing could also act as stabilizers in flight. (2) Hydroplane-operating gear. (3) Electrically-driven air compressors. (4 and 5) Compressed air storage cylinders for blowing water from ballast tanks when rising to surface. (6) Bottom of hull. (7) Water-control valves. (8) Watertight bulkheads. (9) Ballast tanks flooded for submerging. (10) Depth charges for attack mission. (11) Oxygen-breathing apparatus. (12) Armoured glass look-out. (13) Crew escape-hatch. (14) Starboard turbo-jet engine. (15) Retractable lightweight periscope. (16) Front watertight engine seal (closed when submerged). (17) Engine air-intake in flight. (18) Port turbo-jet engine. (19) Engine controls. (20) Anti-icing strip. (21) Retractable wing-tip floats folded. (22) 'Elevons' – acting as elevators and ailerons in flight and driving controls when submerged. (23) Elevon control jacks. (24) Water-intake duct to propeller. (25) Electric propulsion motor. (26) Shrouded propeller for underwater propulsion. (27) Fuel tanks in fuselage. (28) Front watertight engine seal (closed). (29) Rear turbo-jet engine. (30) Rear watertight engine seal (closed). (31) Rudder controls. (32) Twin rudders. Normal flight controls would operate satisfactorily under water.

Sequence in operation.
A. Sub-Plane in flight, using jet engines.
B. Alighting on water. C. Engines sealed, ballast tanks flooded and plane submerging.
D. The plane proceeding to target, driven by electric motors.



HEROS IS *NETTED!*... Page 5.

THE *BOGUS* IRON MAN!... Page 14

EAGLE

and BOYS' WORLD

7d

4 December 1965
Vol. 16 No. 49

EVERY WEDNESDAY

With a tremendous roar, the British destroyer *Blanche* exploded and sank off Harwich in an inferno of smoke and flame. It was November 13, 1939, and a Nazi 'secret' weapon had struck its first blow at the Royal Navy.

ARMS THROUGH THE AGES

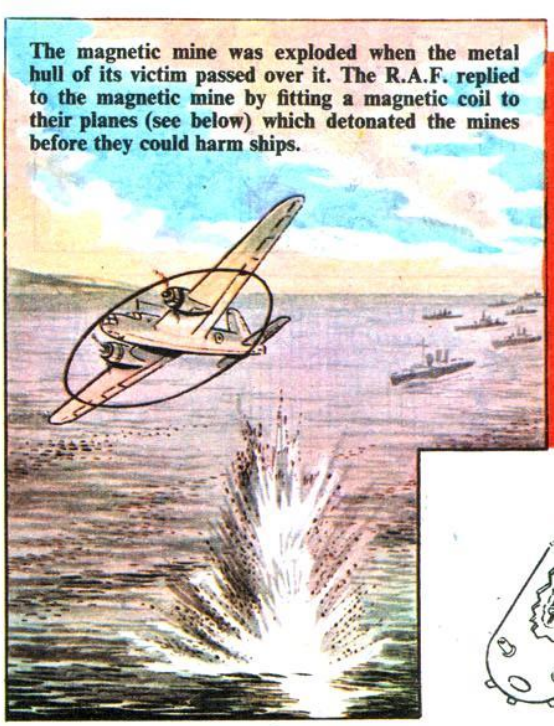
No. 19

THE MAGNETIC MINE

H.M.S. *Blanche* had been destroyed at the very entrance to her harbour by a magnetic mine dropped a few hours earlier by a German aircraft.

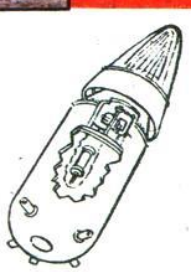
Magnetic mines were only effective in shallow water, such as estuaries and harbour entrances, as the magnetism of a ship's hull was not strong enough to attract the needle through deep water.

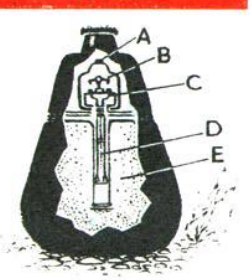
The magnetic mine was exploded when the metal hull of its victim passed over it. The R.A.F. replied to the magnetic mine by fitting a magnetic coil to their planes (see below) which detonated the mines before they could harm ships.



Magnetic mines could be laid by submarines or dropped from specially-fitted aircraft. When a mine came to rest on the seabed, it remained harmless until a seal (A) had been dissolved by the action of sea-water. Thereafter, the metal hull of a ship passing over it attracted upwards a small pivoted magnet (B), which then touched a contact (C) to complete the electrical circuit. This allowed a current to set off a detonator (D), which in turn fired 650 pounds of high explosive (E).

SEE PAGE 19





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BARREL-WINGED TRANSPORT

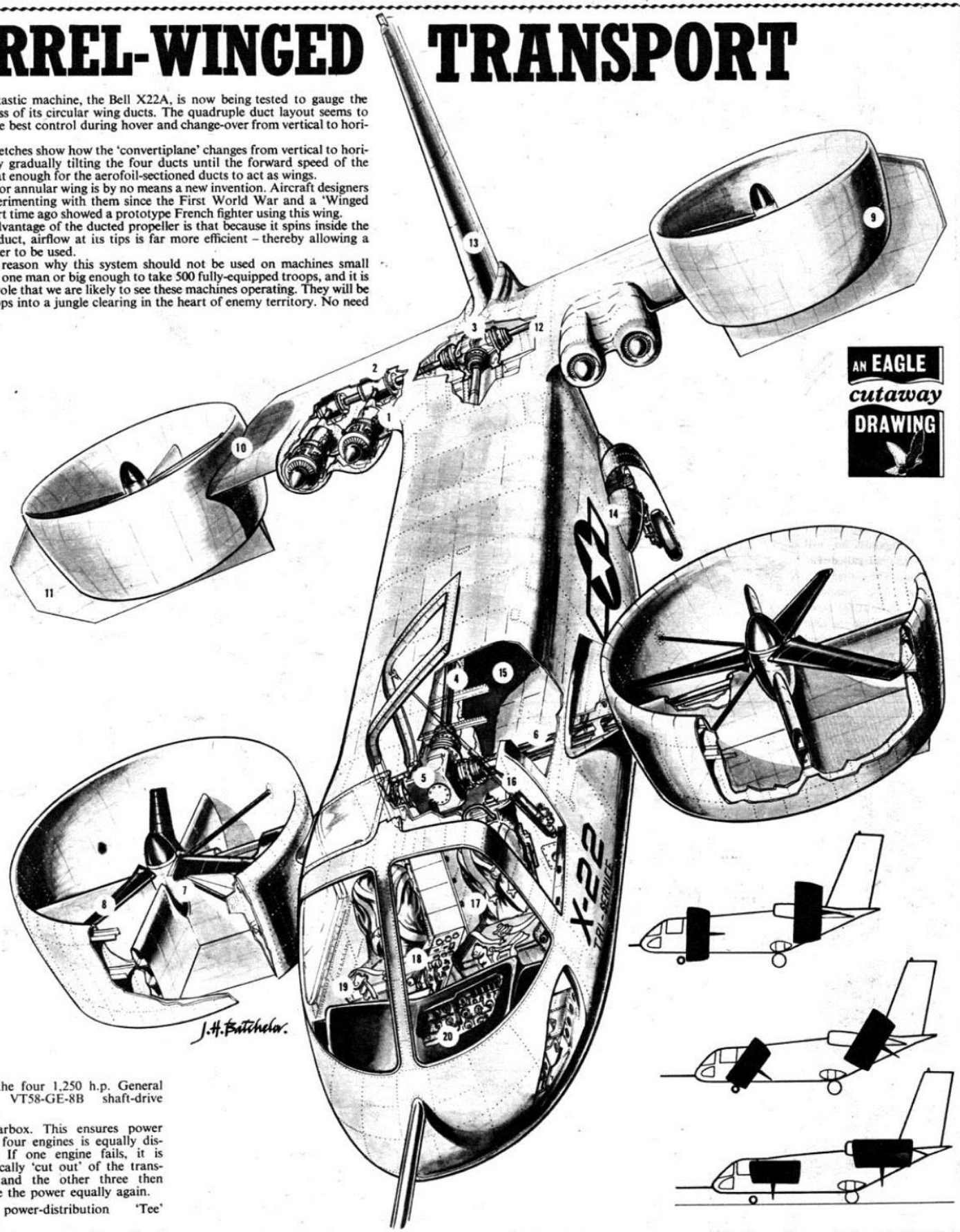
THIS *FAN*tastic machine, the Bell X22A, is now being tested to gauge the effectiveness of its circular wing ducts. The quadruple duct layout seems to provide the best control during hover and change-over from vertical to horizontal flight.

The small sketches show how the 'convertiplane' changes from vertical to horizontal flight by gradually tilting the four ducts until the forward speed of the machine is great enough for the aerofoil-sectioned ducts to act as wings.

The circular or annular wing is by no means a new invention. Aircraft designers have been experimenting with them since the First World War and a 'Winged Wonder' a short time ago showed a prototype French fighter using this wing.

One great advantage of the ducted propeller is that because it spins inside the barrel-shaped duct, airflow at its tips is far more efficient – thereby allowing a smaller propeller to be used.

There is no reason why this system should not be used on machines small enough to take one man or big enough to take 500 fully-equipped troops, and it is in this second role that we are likely to see these machines operating. They will be able to fly troops into a jungle clearing in the heart of enemy territory. No need for runways.



KEY

(1) One of the four 1,250 h.p. General Electric VT58-GE-8B shaft-drive turbines.

(2) 'Tee' gearbox. This ensures power from all four engines is equally distributed. If one engine fails, it is automatically 'cut out' of the transmission and the other three then distribute the power equally again.

(3) Main power-distribution 'Tee' gearbox.

(4) Shaft bringing power to forward end of machine through . . .

(5) Secondary main 'Tee' box.

(6) Shaft transmitting power to propellers in ducts.

(7) Shaft drives propeller through 90 degree gears in pod.

(8) Four 7-foot-diameter propellers which rotate at 2,590 r.p.m.

(9) Each of the four ducts is like a wing which has been bent into a circle. Even though it has been bent it still has the same lifting qualities. If you add up the surface areas of the four ducts and rear wing, the 'convertiplane' has a larger-than-average wing area.

(10) The ducts swing through 90 degrees to face either for lift (as they are now) or forward for horizontal flight.

(11) More lifting area is provided behind and through the centre of each duct.

(12) Drive shaft to duct.

(13) Fin. This machine has no rudder.

(14) Part of the main retractable undercarriage.

(15) The interior of this particular machine has very little trim in it because it is purely for research.

(16) Hydraulic rams lift side panels for entry and exit.

(17) Crew of two sit in rocket-boosted ejector seats. In starboard seat sits the test pilot – port seat is used by second pilot.

(18) Dual controls and instruments are installed.

(19) Starboard joystick (port and starboard).

(20) Part of mass of test instruments.

EAGLE and BOYS' WORLD

23 July 1966 Vol. 17 No. 30 EVERY WEDNESDAY 7d

Mike Lane faces a tiger Page 6
Dare-devils who challenged Niagara Page 13
World's biggest airliner Page 17
The floating death trap Page 19

DID IT EVER HAPPEN?

Many stories are stranger than fiction. Is this one of them – or is it made up? Read it – and then decide.

In 1943 the Germans swooped on a French resistance network. Hundreds of resistance men – and women – were rounded up and lodged in Amiens jail. There they awaited a call at dawn – and the firing squad.

The news was radioed to London, where it was decided that a bid should be made to free the loyal Frenchmen. The biggest jail break in history would be staged – by bombing the walls of the jail.

R.A.F. *Mosquitoes* carried out the daring raid and did their job so well that they knocked down the prison's outer walls without touching the cells. In the confusion caused by the bombing, hundreds escaped through the breached walls.

An incredible story of R.A.F. precision bombing – but did it actually happen? The answer is on page 15.

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WORLD'S BIGGEST JET-AIRLINER

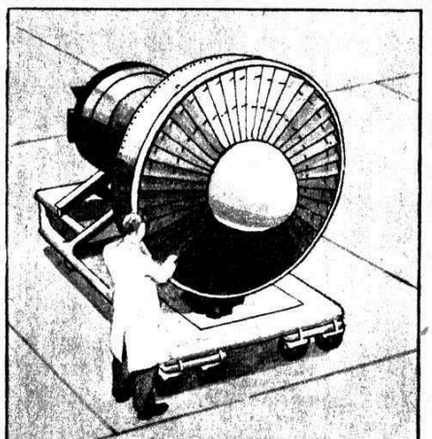
TODAY, there are about 800 big jets in long-distance service with some 50 commercial airlines in the world, and these aircraft have changed man's idea of distance. Now the biggest of them all, the 490-seater Boeing *747*, is being built and will first fly in 1968. Pan American Airlines have ordered 25 of these monsters at a cost of roughly £7½ million each. In this country, B.O.A.C. are also interested.

With a loaded weight of over 300 tons, the *747* will have a cruising speed of 635 m.p.h. at 45,000 ft., flying higher than airliners do today. It will have a range of 5,800 miles with full 490-passenger load and 5,000 pounds of mail and cargo. A special feature is the huge main passenger compartment, 19 ft. 7 ins. wide, stretching from nose to tail. At the forward end, there is a second deck with flight crew compartment and first-class passenger staterooms.

This enormous aircraft will be powered by four Pratt and Whitney by-pass turbofan jet engines of 41,000 pounds thrust each, mounted in pods below the wings.

An all-cargo version of the Boeing *747* will have an upward-swinging nose door for loading, similar to the military Lockheed *C-5A*, published in EAGLE on 2nd April this year. Boeing *747* dimensions are: – Length, 228 ft. 6 ins.; span, 195 ft.; height 62 ft. 7 ins.

How it all started 25 years ago. Britain's first jet aircraft, the Gloster-Whittle *E28/39*, compared to scale with the Boeing *747*. Engine thrust 850 pounds.

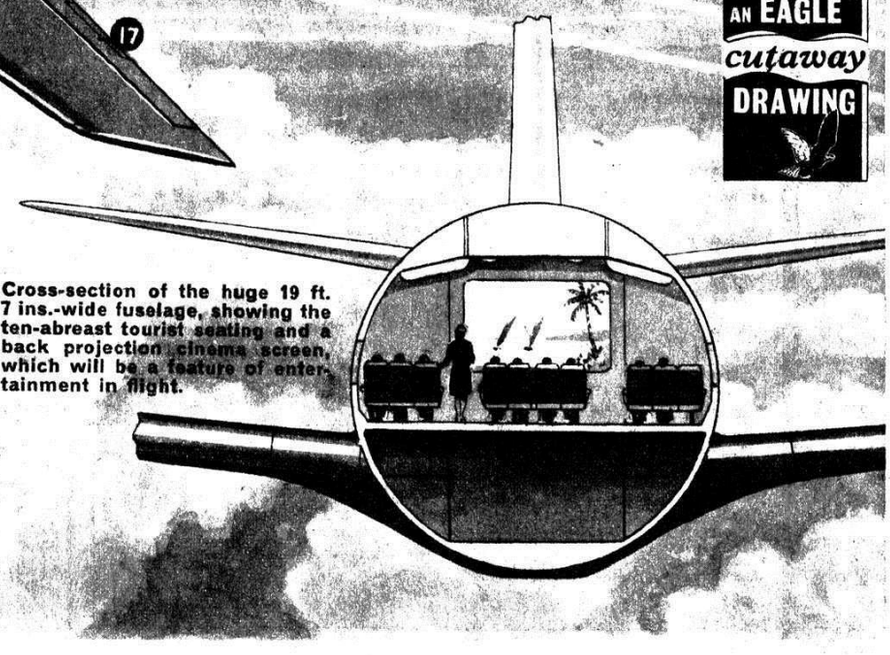


One of the Boeing *747* by-pass turbofan engines of 41,000 pounds thrust with an 8 ft.-diameter fan. Each engine costs £245,000 and weighs 3½ tons.

KEY TO NUMBERED PARTS

(1) Flight deck. Captain, Co-pilot, Flight engineer, Navigator and Radio Operator. (2) Nose cabin. (3) Nose wheels – retracted. (4) One of four passenger doors forward. (5) First-class staterooms on second deck. (6) Toilets and galley. (7) Loading doors for special cargo containers. (8) Forward cargo hold. (9) Centre section fuel tank. (10) Electric anti-icing leading edge. (11) Inner port Pratt and Whitney by-pass turbofan jet engine. (12) Turbofan of outer port engine. (13) Two spool compressors. (14) Combustion chambers and turbine wheel casing. (15) Wing fuel tanks. Total capacity of all tanks, 48,000 gallons. (16) Leading edge flaps used for landing. (17) Port ailerons. (18) Wing spoilers; when raised these act as an additional roll control with the ailerons. (19) Double slotted flaps, used for take-off and landing. (20) Air brakes (lowered). (21) Four bogies abreast main undercarriage (retracted). (22) Ten abreast seating of the main tourist class compartment. (23) Wing spoilers, raised. (24) Flying control runs and cabin air conditioning equipment. (25) Rear cargo doors. (26) Galley. (27) Toilets. (28) Electric anti-icing to fin leading edge. (29) End of pressurized passenger compartment. (30) Tail plane pivot. (31) Rudder and elevator flying controls. (32) Rudder with trim tabs. (33) Elevators with trim tabs.

AN EAGLE *cutaway* DRAWING



Cross-section of the huge 19 ft. 7 ins.-wide fuselage, showing the ten-abreast tourist seating and a back projection cinema screen, which will be a feature of entertainment in flight.

ASHWELL WOOD

BIG SWING-WINGER FROM RUSSIA

AN EAGLE *cutaway* DRAWING

The MIG VG with wings in the fully forward position

LASHWELL LWOOD

Now the Soviet Union is swinging — a previously unknown swing-wing air-craft has made a public appearance and is scheduled for production. Some details have been revealed and the aircraft bears a striking resemblance to the American F-111, which is on order for the R.A.F., except that it is a single-engine single-seater fighter.

Known as the MIG VG (Mikoyan Gurevitch), this swing-winger is powered by a TDR turbojet engine of 25,000-pounds thrust with afterburner, and has a top speed of about Mach 2.5 (1,900 m.p.h.) A big main fin and a large neutral fin under, typical MIG features, give the aircraft a distinctive appearance. The wings can be fully swept backward and forward in four seconds. They are swept backward for high speeds and forward for lower speeds and landing. The all-moving swept tailpiece acts as elevators and ailerons-elevons.

The MIG VG has impressed all observers with its performance and appears to be designed for home defence.

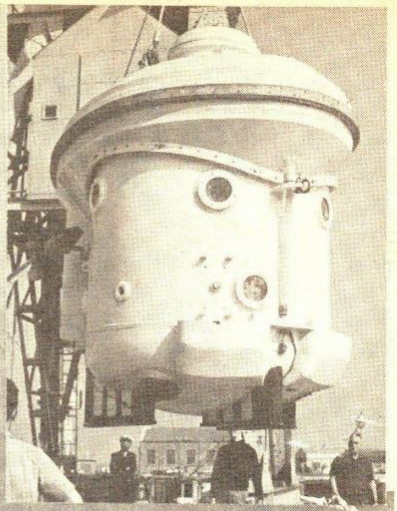
Span: 28ft. (fully swept), 50ft. 6ins. (fully forward); length: 59ft.; height: 17ft.

KEY TO NUMBERED PARTS

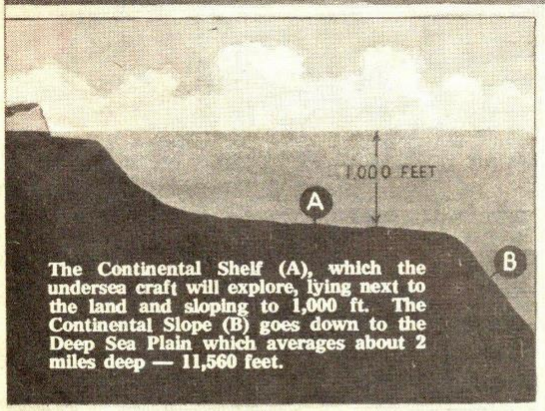
(1) Radar probe. (2) Search radar scanner. (3) Main electronics bay. (4) Steerable nose wheels (retracted). (5) Air entry for boundary layer over wings. (6) Air entry to engine trunks (both sides). (7) Single-seater cockpit and ejector seat. (8) Control runs for swing-wings. (9) Forward fixed wing section. (10) Fuel tanks. (11) Starboard wing pivot. (12) Hydraulic motors operating screw-jacks. (13) Steel bridge for wing pivots. (14) Swing-wing screw-jacks. Screw outwards for sweep back—retract for bringing forward. (15) Port wing pivot. (16) Swing-wing brackets. (17) Position of wing when fully forward. (18) Air-to-air missile. (19) Pivoted missile carrier. (20) Fuel cells in swing-wing flexible pipes move with the pivot. (21) Bifurcated (split) engine air trunks. (22) Air chambers to engine fan. (23) TDR turbojet engine. (24) Swing-wing in fully swept position. (25) Ventral fin. (26) Tail-plane activator. (27) Moving tail-plane or elevon. (28) Afterburner giving a total thrust of 25,000 pounds. (29) Jet nozzle. (30) Braking parachute container, used when landing. (31) Rudder. (32) Infra-red tail warning light.

BRITAIN'S FIRST UNDERSEA CRAFT

Known as a Standard Underwarter Research Vessel, this two-man submarine is capable of working at depths of up to 1,000 ft. for sea-bed exploration. Its many uses will include underwater surveys for the laying of new gas pipelines, oil pipelines and telephone cables. Geologists will be able to study the sea-beds for off-shore gravel and mineral deposits. Marine Biologists will study undersea life and provide information about fish movements, etc. The working depth of 1,000 ft. brings observation of the Continental Shelf around our coasts and about half the world's ocean beds within reach. S.U.R.V. is roomy, the two operators being able to move about under atmosphere pressure in a large steel pressure hull. There are ten Perspex glass viewing ports in the hull and provision is made for cameras and cine-cameras; also a manipulating arm or claw for picking up specimens. Two electric motors of 2½ h.p. each, one each side of the vessel, can be rotated through 100 degrees to drive the craft in any direction at a speed of 2½ knots. These can be used for descending to the sea-bed, ascending and forward and reverse travel. The craft weighs 6 tons and was built by Lintott Engineering at Horsham, Sussex, in co-operation with the Ministry of Defence.



AN EAGLE *cutaway* DRAWING



The Continental Shelf (A), which the undersea craft will explore, lying next to the land and sloping to 1,000 ft. The Continental Slope (B) goes down to the Deep Sea Plain which averages about 2 miles deep — 11,560 feet.

KEY TO NUMBERED PARTS

(1) Manipulating claw. (2) Releasable ballast weights. (3) Downward viewing port. (4) Forward ballast trim box. (5) Viewing light. (6) Two control arms, for all operations and instrument panel (7) Oxygen bottles for crew breathing requirements. Carbon-dioxide is absorbed by soda lime containers. (8) Viewing port. (9) Rear ballast trim box. (10) Buoyancy trim tanks (each side). Sea water is admitted at will and compressed air is used to blow it out. (11) Inverter for converting the D.C. current from the batteries to A.C. current for the propulsion motors. (12) Free flooding area. (13) Batteries of 146 volts in pressure-proof pods. (14) Compressed air cylinder for blowing buoyancy tanks. (15) Three-bladed propellers (each side). (16) Electric propulsion motors in pressure-proof casing. (17) Each propeller unit can rotate through 100 degrees. (18) Instrument panel for gyro-compass, turn indicator, oxygen flow control, ballast release, etc. (19) Two-way through water ultrasonic speech microphone. (20) Electric depth indicator from the sea-bed or from the surface. (21) Steel pressure hull, designed to withstand sea pressure of over 600 pounds per square inch. (22) Forward viewing port. (23) Towing eye. (24) Position of water level when craft is on the surface. (25) Fibre-glass casing surrounding the pressure hull. (26) Free flooding area when submerged; when surfacing this surround is blown free of water to give surface buoyancy. (27) Fluorescent lighting. (28) Fibre-glass surround. (29) Surface identification markings. (30) Ultrasonic speech aerial. (31) Entrance hatch. (32) Hatch viewing ports. (33) (Below) Submarine telephone cable.

ASHWELL WOOD

EAGLE

The modern paper for the modern boy

17 February, 1968. Vol. No. 7
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BEGINNING TODAY!

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IRON MAN

Meets His Match

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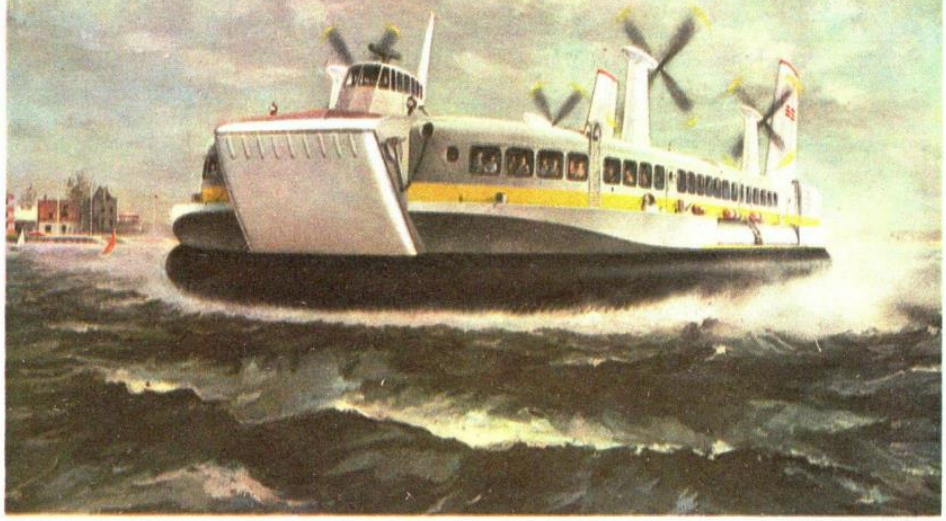


THE FUTURESCOPE – Looking into the World of Tomorrow

Greek legend has it that Icarus, in company with his father, Daedalus tried to imitate the flight of birds with wax-fastened wings. But the sun melted the wax and Icarus plunged into the sea

BIONICS THE COPYCAT SCIENCE

ON the shores of San Pedro, California, space researchers are fishing! All in the interest of science, of course! They fish for the opal-eye perch, to wrest from it the secret of its digestion. It seems the little, yellow-green fish can thrive on a daily diet of algae, but man cannot.

Like their earth-bound brothers, astronauts get hungry and thirsty. And providing sustenance for them is expected to become an increasingly pressing problem as journeys grow longer.

Algae — fast-growing, rich in nutrients, with oxygen-producing and water-purifying properties — could hold the answer. Provided, that is, it can be made digestible.

The inquiry into the eating habits of the opal-eye perch, now being continued at North American Aviation's Space Division Laboratories, was prompted by a new field of study called bionics. This is 'the study of the structure, function, and mechanisms of plants and animals to gain design information for analagous man-made systems.'

MAN-MADE SYSTEMS

In other words, by studying how animals, insects and plants respond to their environment, scientists hope to help the engineer design improved man-made systems based on those conceived by Nature.

The idea is not a new one, of course. Back in the days of Greek mythology, Icarus pasted some feathers to his arms with wax and attempted to copy the birds. Never before, however, has any organized scientific attempt been made to rival the highly efficient sensing and adaptation systems belonging to living organisms.

Now scientists are making a concentrated effort to catch up, taking a brand-new approach to the solution of design problems.

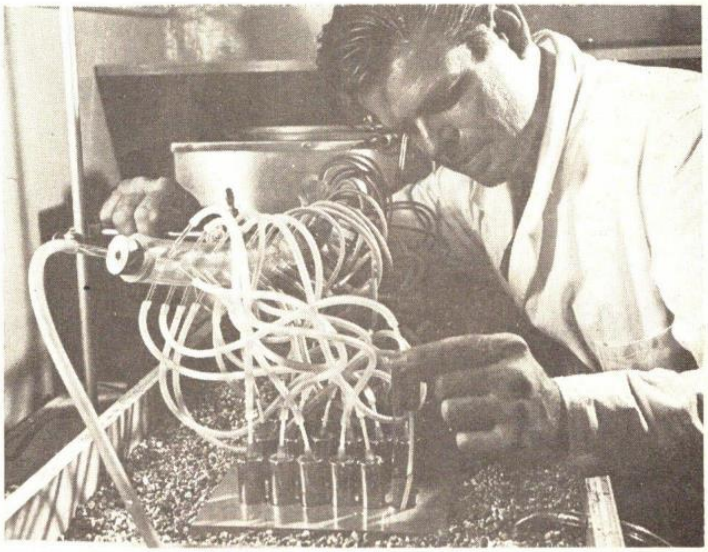
Consider, for instance, the frog sitting motionless beside a pool, idly day-dreaming, apparently oblivious of its surroundings. But appearances are deceiving. For beneath that calm exterior, the frog is ever poised for instantaneous action, ready to snatch at a passing insect or scramble for safety.

Those bulging, staring, seemingly unseeing eyes are to the frog its means of survival. With them the frog finds food and guards against enemies.

A frog's eye, biologists have discovered, is a very selective organism — it sees only what it wants to see. To the frog's simple brain comes news of only two things— bugs and danger.

Its eye will not transmit other information as it does not respond to backgrounds, either moving or still, but concentrates solely on objects moving against a background. All other images are screened out.

What this suggests to engineers is that some day a delicate and very



Here, a biologist studies the effect of light and heat on the growth of algae — during experiments to test its use as a human food supply

useful screening process, that filters targets on a radar screen, might be developed to rival the sensitive eye of a frog.

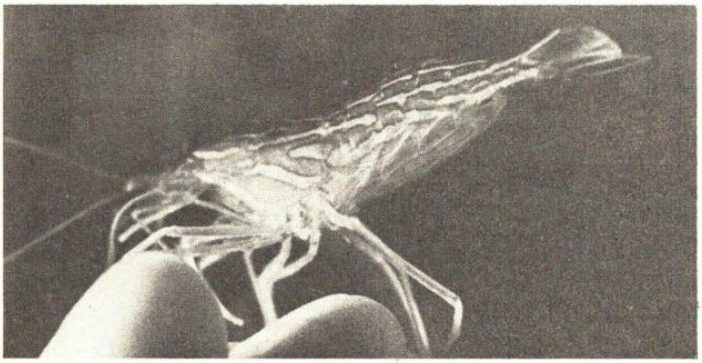
Consider, too, the shadowy world of the near-blind bat, where echo-producing sound replaces light as a guide. For millions of years before man thought to use them, ultrasonic vibrations had rendered this tiny mammal capable of feats of echo-location that engineers find hard to believe and — as yet — impossible to match.

The larynx of the bat provides a sonar that enables it not only to find its way in the dark, but to detect and locate its prey as well — a sonar so sensitive that it can pick up echoes from a mosquito out of a background noise 2,000 times stronger than the mosquito's signal.

The bat's keen ears then interpret the echoes somewhat as a radar operator in an aeroplane does.

In short, the bat comes equipped with a natural radar device that is far superior to that which has been invented by man.

The study of such living ears could well produce better listening systems and other important objectives.



Biologists are experimenting by getting shrimps to replace the grains of sand inserted at the base of their antennae with grains of iron — all in the cause of space research

BAT'S SONAR

It might, for example, be the way to free ourselves of unwanted pests. If we could jam the bat's sonar, we could conceivably keep him out of areas where he is not wanted. Or, if we could simulate his ultrasonic cries, we might prevent moths from invading fields, or even get rid of mosquitoes by decoying them with romantic but artificially produced buzzing.

And, since not only bats but various birds have learned sonar, might not man develop this same listening skill to supplement his other senses? It's not beyond the realm of possibility, say bionicists.

Birds have a delicate built-in navigational aid that guides them unerringly on their migratory flights.

We humans cannot accurately note a fraction of a degree change on a thermometer, yet the highly sensitive rattlesnake measures temperature within a thousandth of a degree.

A moth protects itself by diving like a submarine when its sensitive ears detect the sonar cries of its enemy, the bat.

A sand flea, a minute speck of life, gets its bearings from the moon, using a microscopic computer.

Not to be overlooked are the clever shrimps and lobsters that place tiny grains of sand at the base of their antennae after each moulting, a trick that gives these creatures an amazing sense of balance in the near-weightlessness of underwater living. And, in the same category, there is the odd ability of the Mexican boa's eye slit to maintain an equilibrium no matter how the snake is twisted and turned.

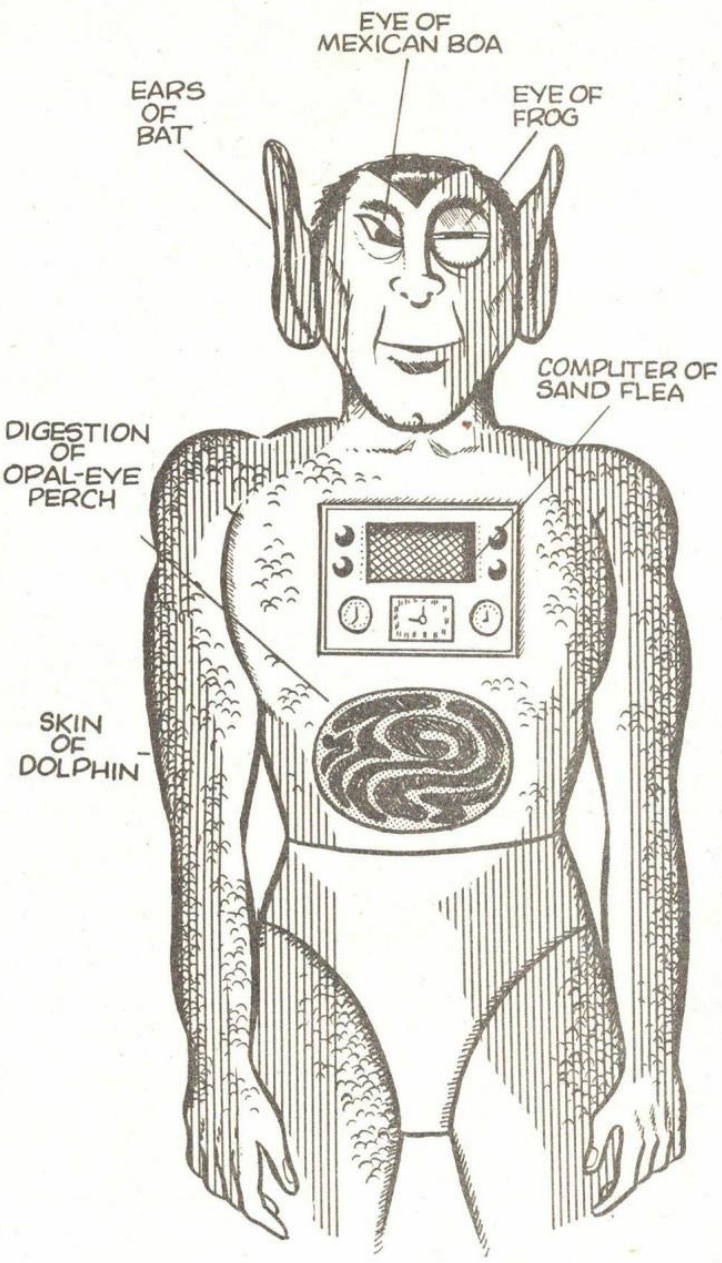
In a bionics study of the beetle's eye, which took place at the Max Planck Institute for Behavioural Physiology in Germany, it was found that the beetle could judge speed! Analysing the beetle's behaviour revealed that this insect measures its speed by the time taken for an object to move from one part of its compound eye to another, and correlating this arrival time to its brain centre.

So the researchers copied the beetle by placing a photo-electric cell in the nose of an aircraft and another in its tail, then connecting both to a computer. The result is a ground-speed indicator believed to be the first truly reliable one.

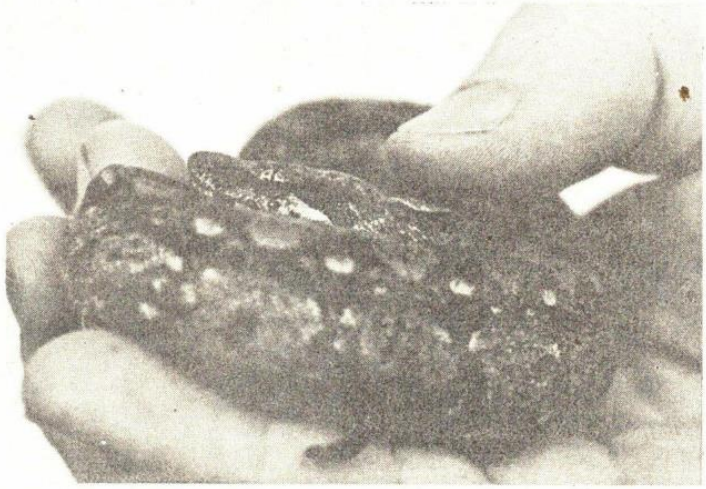
As cue after cue is taken from nature's bag of tricks, this copycat science, though not yet out of its infant stage, is already producing much in the way of tangible results. At General Electric Co., a better TV camera was developed. It simulated the mechanism of the eye of the horseshoe crab. Similarly, because of bats, Lockheed Missile & Space engineers were able to devise echo-location boxes to help the blind orient themselves. And Cessna Aircraft Corp. is marketing a commercial plane with the wing patterned after that of a bird.

Other examples of how bionics has been adapted to serve man include such advances as thinking computers that have evolved from nerve-cell research, and the internally worn heart stimulators which were developed from the study of animal electricity.

Then there is the streamlining artificial skin, called Lamiflo, that will eventually be applied to ships, submarines and airplanes, to enable them to travel faster. Lamiflo was fashioned after the skin of the dolphin, which is believed to be responsible for the impressive speed this mammal attains.



Artist's impression of an artificial being which man might create with the development of the science of bionics to contain all the ideal features



Creating immense interest among scientists is the ability of the Mexican boa's eye slits to remain in a fixed position regardless of how the snake is twisted and turned

THINGS TO COME

These, and other accomplishments, are but signs of greater things to come. In the future, much is expected and much is to be gained from the happy union of biology and engineering. New and varied paths of research are constantly being opened in the name of bionics, paths that can lead to truly great advances in technology. And they all begin with Nature's designs.

Which brings to mind the ancient proverb that says, 'Go to the ant, thou sluggard. Learn her ways and be wise.' Well, why not? The ant *is* wise, and we 'sluggards' do have much to learn!

AHOY—IT'S THE WORLD'S BIGGEST HOVERCRAFT!

THE summer holidays may be nothing but a gleam on the school horizon at the moment, but you can take cheer from the prospect of then being able to skim the Channel in the world's biggest hovercraft. For some time in August the giant SR.N4 is due to begin cross-Channel operations, thus heralding the first step towards a transatlantic hovercraft service.

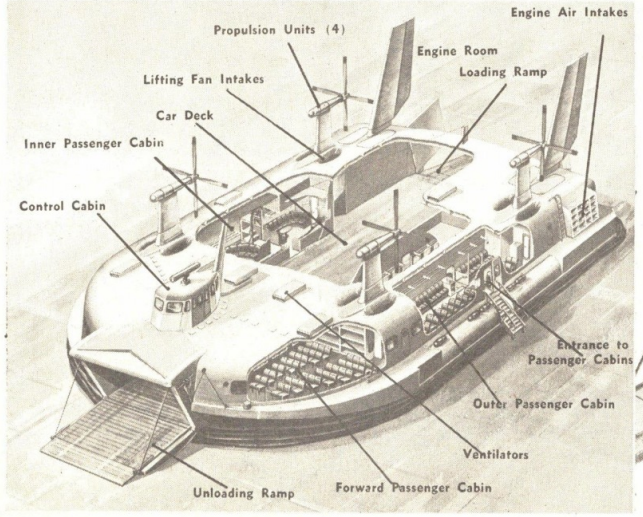
The 165-ton, 130-foot-long SR.N4 is the size of a 600-seat cinema. It will carry 254 passengers and 30 cars across the Channel at 70 m.p.h. in about 35 minutes, roughly half the time taken by existing ferry boats. An all-passenger type can provide over 600 seats.

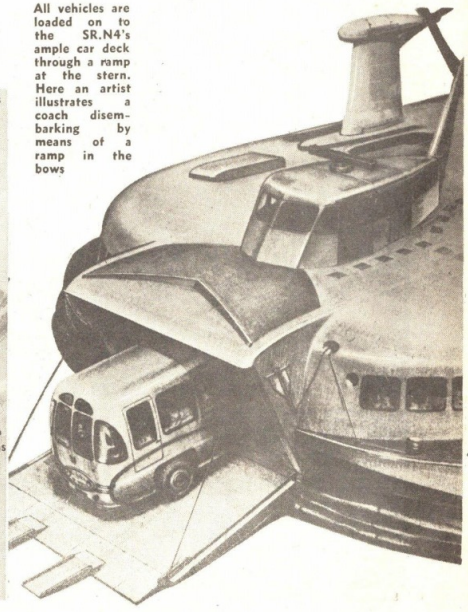
This superb achievement of British engineering skill and technical know-how is the result of ten years of experiment and design which began with the first prototype hovercraft, SR.N1, launched in May, 1959. The SR.N4 — costing nearly £2 million — consolidates Britain's world lead in hovercraft; export orders worth more than the combined total of our aircraft and shipbuilding industries are expected.

Two companies will operate the SR.N4 cross-Channel services. British Rail Seaspeed will start this August; and Hoverlloyd (who now run the 38-seat SR.N6 Channel ferry) will begin some time next year. To house the huge hovercraft special hoverports will be built, one of which will be sited at Pegwell Bay, near Ramsgate, Kent.

The SR.N4, 42ft. 5ins. high and 76ft. 10ins. across the beam, is powered by four Bristol Siddeley 'Marine Proteus' gas turbine engines, each driving a variable-pitch propeller mounted on a pylon. Interconnected with the propellers are four centrifugal fans for cushion air.

The craft is controlled by varying the propeller blade angles, and by swivelling the pylons to change direction of thrust. If a single engine should fail, the craft can still proceed on the remaining three; in the unlikely event of two or more engines failing, the craft, being completely buoyant, can move as a displacement vessel on the remaining engines.





All vehicles are loaded on to the SR.N4's ample car deck through a ramp at the stern. Here an artist illustrates a coach disembarking by means of a ramp in the bows

CAR DECK

The centre of the craft is occupied by the car deck, with large doors in the stern and ramp in the bow to provide drive-on/drive-off facility. On either side of the car deck are the passenger saloons, equipped with comfortable seats for all passengers and large windows extending the full length of the craft. The trip will be like taking a smooth express coach over the Channel.

The basic idea of the hovercraft, or Air Cushion Vehicle, is an old one, and over the past 100 years inventors all over the world have put forward various proposals and designs; but the hovercraft as we know it today is a purely British invention. It was Christopher Cockerell, 'Father of Modern Hovercraft', who experimented with and developed the basic idea, patenting his ACV design in 1955.

PROTOTYPE

He built his first hovercraft model from an old coffee tin and balsa wood. From the 7-ton prototype, SR.N1, grew the 27-ton SR.N2 — the first serious attempt to produce a commercial hovercraft — which was launched in January, 1962. Then came the 37½-ton SR.N2 Mk 2 (military version designated SR.N3), capable of carrying 150 passengers or 12 tons of freight at up to 70 knots.

Next the SR.N4 was planned. The first production line hovercraft was the 7-ton SR.N5, sold to the Ministry of Defence, the United States, Germany, Japan and Norway. From this successful craft was developed the 9-ton, 38-seat SR.N6.

The first operational military hovercraft to be used on active service was the SR.N5. It was used in 1965 by the British Army against the Indonesian guerillas who invaded Malaysia; and is currently being used by United States Special Forces in South Vietnam. These craft were fitted with armour-plate and machine-guns. A new version being developed is the fast 75-knot, 40-ton military patrol-boat BH.7, armed with missiles and a light gun.

'SILENT' HOVERCRAFT

Planned for the future is a 400-ton Royal Navy hovercraft, able to hunt and destroy nuclear submarines. It will take the shape of a ship that converts to a hovercraft at the touch of a button, rising above the water to race over the waves at 100 m.p.h. It will be twice as fast as a nuclear submarine, and able to run up beaches and park on land — the equivalent of bringing a frigate ashore.

Another pioneer craft being developed is the world's first 'silent' hovercraft, with a whispering air-jet propulsion system powered by a Rolls-Royce engine. Existing models have noisy aircraft engines, although this is minimized by the selection of appropriate fan and propeller tip speeds.

The potential use for hovercraft is tremendous. The future should bring forth a hovercar, a hovertrain, hovertractor, hoverscooter, hovertank, and hoverlifting machines for use in industry. Hovercraft could even be used to explore the Arctic, thus eliminating one of the hazards of polar expeditions — crossing hidden crevasses.

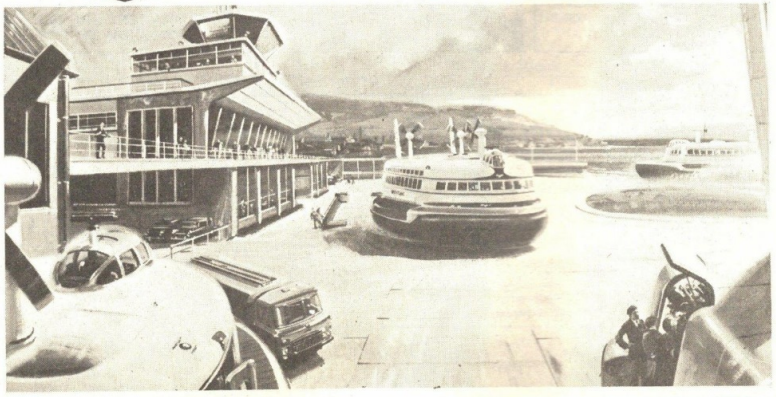
And it is British engineering skill, technology and brain power which is leading the way. The SR.N4 is the latest proof of that.

An artist's impression of the multi-seated interior designed to give passengers the maximum of comfort

Below: The first operational, military hovercraft, the SR.N5, fitted with armour plate and machine guns

One day, no doubt, you will be able to judge for yourselves just how exact this artist's impression of a future Hoverport really is. Perhaps there will even be a vast international network of such ports, providing fast and reliable Hovercraft travel all round the coast of Europe

Envisaged for the future is this 75-knot, 40-ton military patrol-boat, armed with missile and a light gun, at present under development



● Next Week: THE GHOST SHIP RISES!

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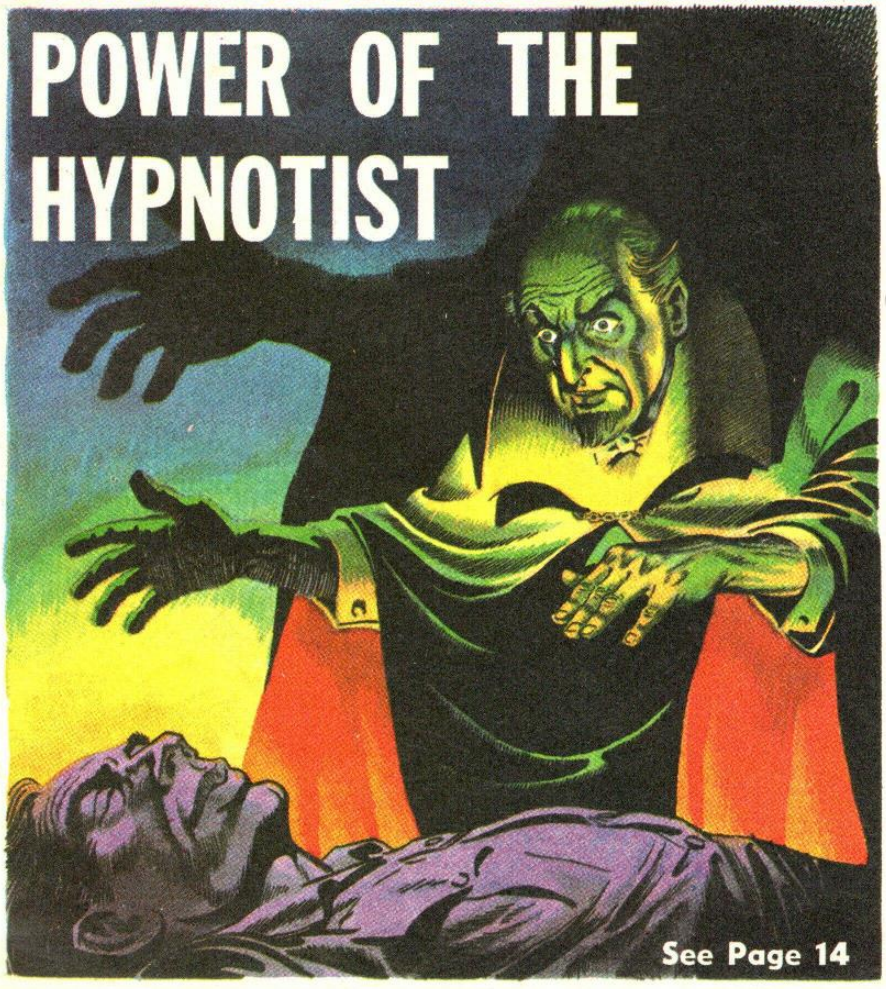

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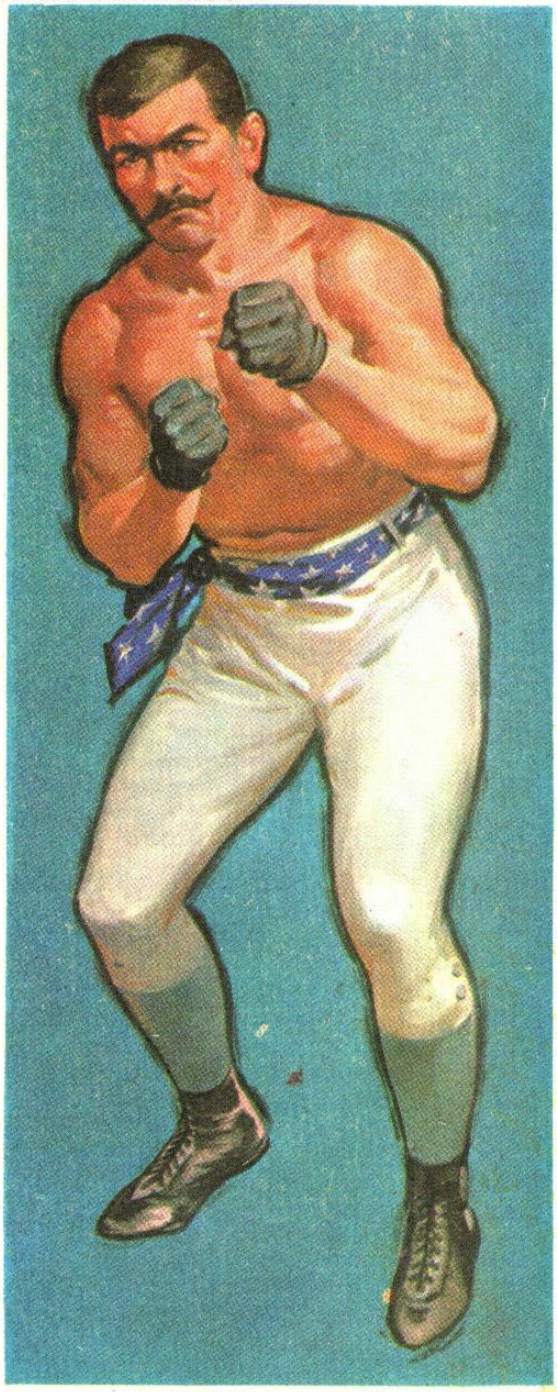


LAST OF THE BARE-KNUCKLE FIGHTERS

See Page 8

FLYING LORRIES OF THE FUTURE

No fantasy but a distinct possibility — a flying lorry which could travel from London to Birmingham in about 25 minutes, with a 10-ton load.

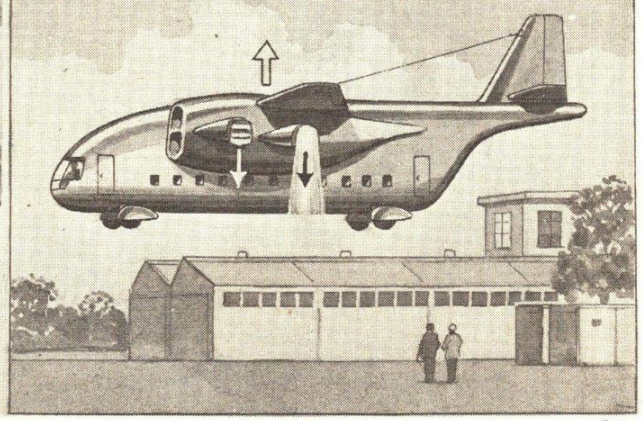
The proposal to produce a giant, high-speed, vertical take-off and landing (V/TOL) jet transport has been submitted to the Ministry of Defence by Bristol Siddeley Engines. It is the invention of Dr Stanley Hooker, the man responsible for the development of the R.A.F.'s new Harrier V/TOL jet-strike aircraft soon to come into operational service. The flying lorry's top speed will be about 330 m.p.h. and it will have four Pegasus jet engines of 24,000 pounds thrust each, with swivelling jet nozzles for vertical and forward flight. These engines will be mounted in pairs either side of the fuselage. A large hold will carry about 10 tons of cargo in ready-packed containers for quick handling. The flying lorries could be ready for service in two or three years' time and would be the answer to our already congested roads.

AN EAGLE *cutaway* DRAWING

ASHWELL WOOD

(1) Pilot and co-pilot with forward and downward view. (2) Fixed undercarriage. (3) Container in cargo hold. (4) Radio and electronics. (5) Flying and engine controls. (6) Starboard twin engine nacelle. (7) Fuel tanks. (8) Exhaust nozzles are cross-ducted in case of one engine failure. (9) Air inlet to upper port engine. (10) Air inlet to lower port engine. (11-12) Turbo-fan section of Bristol Pegasus engines. (13) Turbo-fan air exhaust nozzle directed fully aft for forward flight. (14) Swivelling nozzle control. (15) Combustion chambers and turbine wheels of the gas-turbine section. (16) Jet outlet to exhaust nozzle. (17) Gas turbine exhaust nozzle directed fully aft for forward flight. Both engines are connected to these swivelling nozzles. For vertical take-off they are directed downwards and gradually directed aft for forward flight. (18) Air pipe from engine to roll control jet. (19) Stub wings giving stability in forward flight. (20). Air jet unit in wing tips for controlling roll of aircraft. (21) Container in cargo hold. (22) Cargo door and operating jack. (23) Fuel tank. (24) Flying controls. (25) Air pipe from engine to tail pitch control. (26) Fin and rudder. (27) Air jet unit for tail pitch control.

The flying lorry in vertical take-off. The turbo-fan air nozzle and the gas-turbine nozzle directed downwards, thus giving lift — the engines accelerated to full power



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BLACKBOW THE CHEYENNE

DICES WITH DEATH

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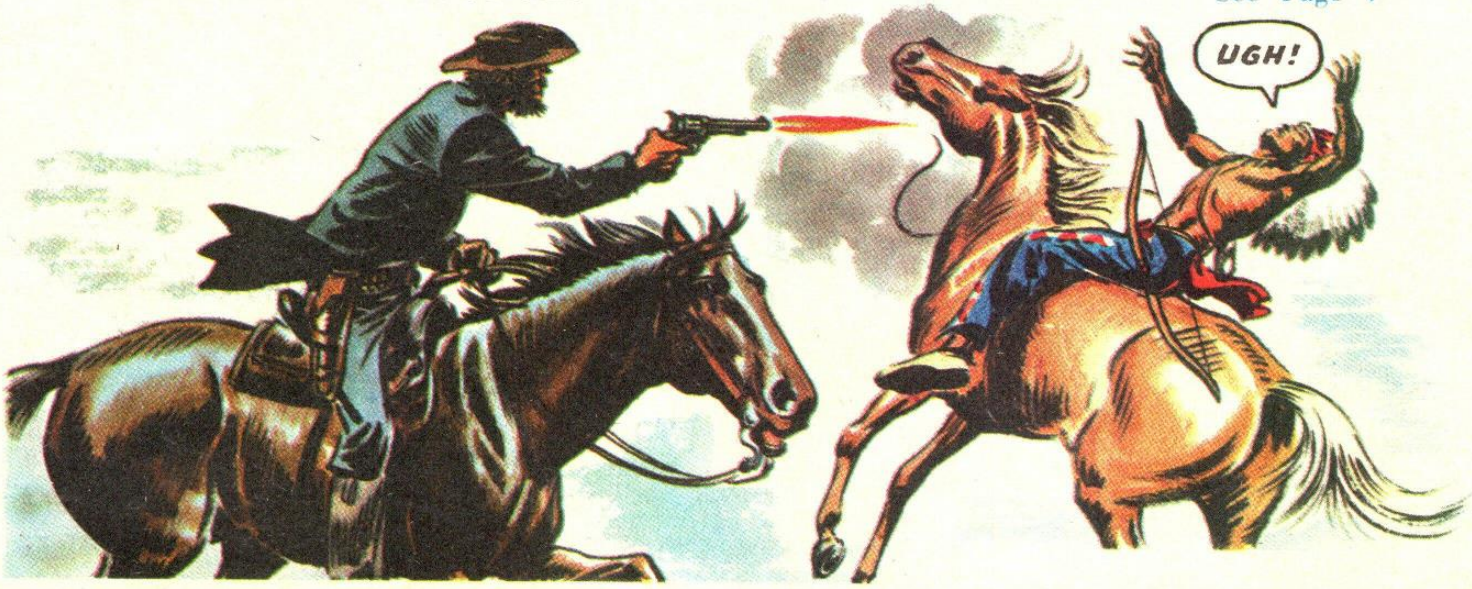
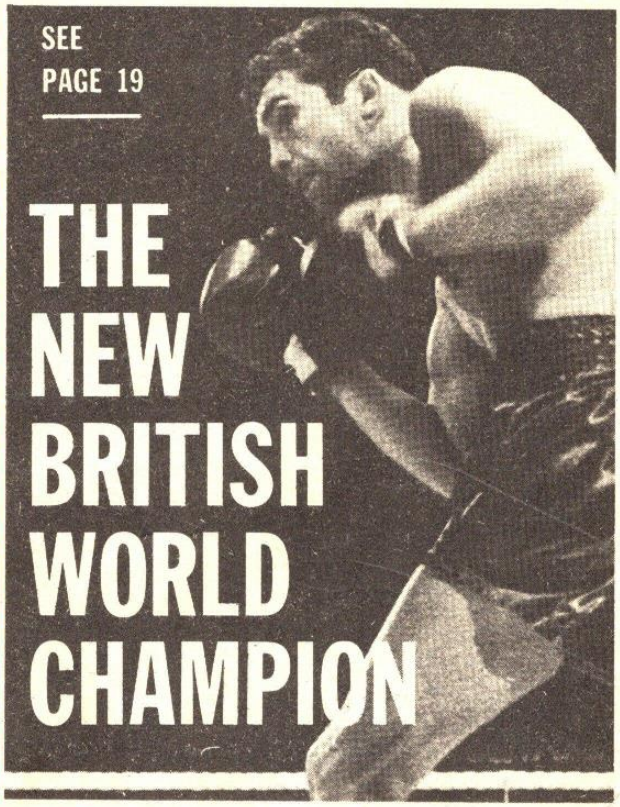


THE GUINEA-PIG OBEYS A CRAZY ORDER

See Page 12

SEE PAGE 19

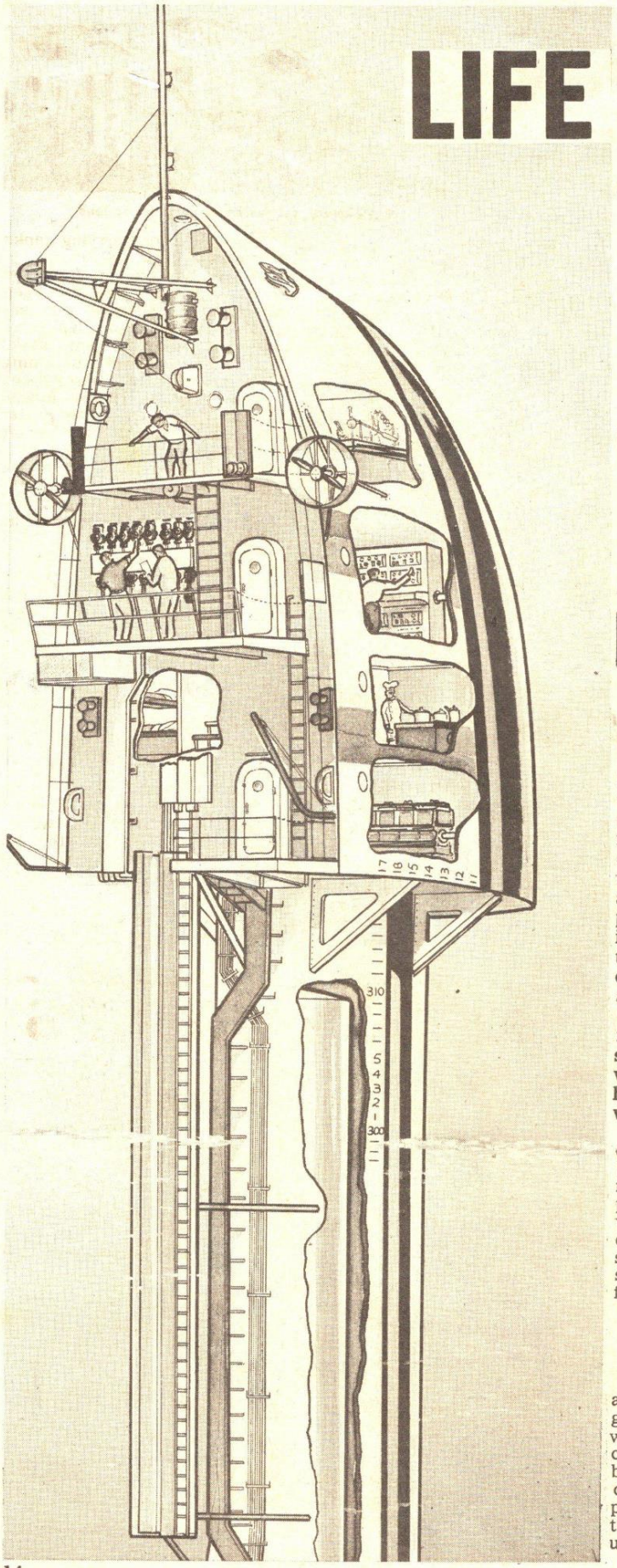
THE NEW BRITISH WORLD CHAMPION

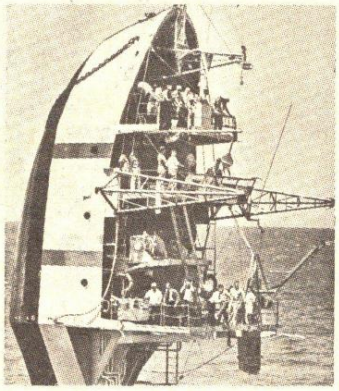


THE FUTURESCOPE – Looking into the world of Tomorrow

LIFE UNDER THE OCEAN WAVE

By Dr Lyall Watson





A ship called Flip. A new sea-going laboratory which is towed out to her research area in a horizontal position and then has her ballast tanks flooded until she is floating in a vertical position with 85 per cent (including underwater view panels) below the surface. (See cutaway on left.)

SOONER or later we are going to run out of land. And the sooner we realize this, the better.

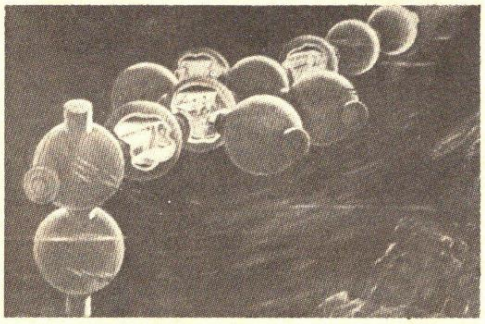
Two thirds of the earth's surface is covered with water and yet we hardly make use of it at all. We have some ships that we use to carry things from one side of the water to the other, but already aeroplanes are taking over all but the heaviest cargo. We use a little of the water to cool machinery, but sooner or later we seem to have trouble with the salt in it.

We take a little of the salt out of it, but only enough to provide fresh water for a small community here and there. A few people eat water plants, like seaweed, and we catch a fair amount of fish, but still we are only scratching the surface of a vast stockpile of living space, energy, food and drink.

TREASURE TROVE

The underwater mineral wealth alone is staggering. There is a great treasure trove in the deep waters of the ocean that must include millions of tons of silver, billions of tons of gold, valleys of diamonds, huge deposits of phosphates and sulphur, untouched masses of copper and uranium and fantastic reservoirs of petrol.

Offshore mining for diamonds and gold is beginning to take place in South Africa and California. And off the east coast of the United States an attempt is being made to recover manganese from some strange potato-like knobs that line the ocean floor there like a cobblestone pavement. But only the big oil companies have really gone into ocean mining and drilling in a serious way and their research is now beginning to open up whole new areas of oceanographic investigation.



A deep ocean work colony designed for use in mid-Atlantic in 1980. People will be working and living in the glass spheres 9,000 feet down

The most important of these is the discovery of new sources of food.

The largest mammals that ever lived are alive now in the sea—the whales. They themselves are not going to provide us with much food, because there aren't that many of them left. But they can provide us with a valuable lesson on how to get more and better food from the ocean. In spite of their enormous size, whales live on the smallest kinds of animal and plant life in the sea. The largest whales eat plankton—and they do so for a very good reason. They eat it because it is the most direct kind of energy-giving food, deriving its protein straight from the sun, and because there is a great deal of it around.

We could and should be doing

the same. It is estimated that we harvest as much as 4,000 tons from each square mile. That's enough protein to feed 200,000 people for a year.

However, not all parts of the ocean are going to be suitable for farming. Some may be better for underwater ranching.

Instead of sheep and cattle there will be mackerel and tuna. And, instead of sheepdogs, there will be trained dolphins equipped with radio receivers so that we can tell them where to bring the fish.

There is even a possibility that the whales may not die out and that we will be able to find a way of breeding them in some parts of the sea. Maybe we will be able to fence off large areas with electronic barriers and have real cowboys going down in small, fast submarines to herd the whales. It is even possible that some of the larger whales will be sufficiently docile for us to herd them into shallow water once a week to be milked. With proper breeding, an adult whale should be able to produce 500 gallons of milk each week.

With selective interbreeding of certain kinds of plants and seaweeds, it is soon going to be possible to plant crops underwater and harvest them with special automatic machines that would transport the crop to processing plants (also underwater) where they would be converted to pure protein that could be pumped ashore.

MEDICAL DISCOVERIES

Ocean plants and animals are also proving to be sources of exciting new medical discoveries. Marine chemists have only just begun their studies, but already they have extracted chemicals that kill pain, some that prevent the growth of tumours, some that fight viruses and even one that stimulates the heart.

But the most exciting developments of all are those which show that man is going to be able to go down into the ocean depths and actually live there. Already we are sending divers down, but it is necessary for them to come back to the surface very slowly so that they adjust to the lower pressure without damaging themselves.

There is no doubt that, by the turn of the century, there will be large communities of people living and working on the ocean beds all over the world. Some of these marine villages may be as deep as 9,000 feet down, doing research on the possibilities of man exploring even the darkest, deepest trenches of the oceans.

But most of them will be in shallow water. Even if none go deeper than 600 feet—the depth of the fertile continental shelf which surrounds all the land masses—we will have opened up a new living space with an area half as large again as that we already occupy.

The important thing to remember is that we are not going to be intruders or tourists in this space. People will live happily and comfortable there in floating glass bubbles or in domed houses attached to the sea bed. Children will be born and grow up there and some might never travel as far as the surface in their lives. There will be no shortage of exciting things to do and new areas to explore and, if one recent development proves practical, they might not even be wearing oxygen masks or carrying tanks of compressed air.

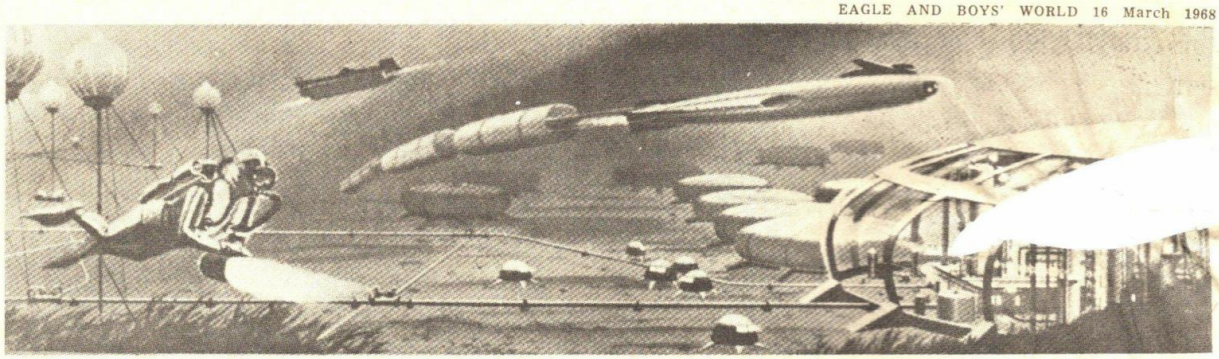
We get our oxygen from the air, which is a mixture of oxygen and nitrogen. Because our ancestors developed on land, we have lungs—which are sacks filled with a tissue containing blood vessels that absorb the oxygen from the air we inhale. Animals that live under water also need oxygen. They get it from the water, which is a mixture of oxygen and hydrogen. Their method is to use gills—which are folds of tissue containing blood vessels that absorb the oxygen from the water.

SPECIAL TESTS

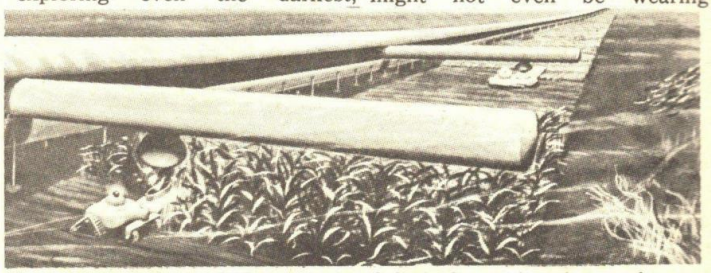
Lungs and gills do the same thing and work in very similar ways. So similar are they, in fact, that mice have been put through special tests in which their lungs were completely filled with water and they were able to 'breathe' by extracting the oxygen from it. With a little more experimenting, it might even be possible for us to do the same.

It is not going to be long, therefore, before we are as much at home under the sea as we are on the land. Perhaps the sea colonists will go to the landside for their summer holidays.

Next Week:
THE WORLD'S BIGGEST EARS



An underwater oilfield of the future. There is a refinery, storage tanks and a living area for the workers—just like on land



An automated farm which is growing hybrid plants adapted to underwater conditions. Overhanging harvesting machines transport crops to the underwater processing plant in the background

BEAUTIES OF THE WORLD ON STAMPS

THIS week we have a selection of girls on stamps, from many different countries.

The German stamp shows a smiling girl at work in a vineyard.

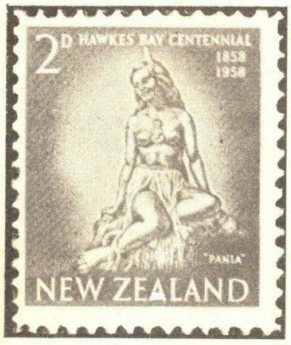
The Spanish Post Office is, at present, issuing a large set of postage stamps depicting beautiful girls in the traditional costumes of various provinces and areas. Our example shows one from the province of Alava, north of Madrid.

The Chinese stamp shows a pretty girl in her finely-embroidered and colourful kimono, the national costume.

From the French colony of Guadeloupe, off the north coast of South America, come several stamps, such as this one here, illustrating their dusky beauties.

Finally, the picture on the stamp from New Zealand is of a Maori girl, a member of the original race which inhabited the islands. Only about 200,000 Maoris have survived, with scientists, doctors, civil servants, engineers and businessmen now amongst them.

Perhaps, one day, we might even see Miss Great Britain on one of our own stamps.



EAGLE

The modern paper for the modern boy

11th May, 1968, Vol. 19, No. 19
EVERY WEDNESDAY

7d

Australia 10c. New Zealand 1/- (10c). South Africa 10s. Rhodesia 1/-. East Africa 1.00. West Africa 10d.

Sky Buccaneers

SCRAMBLE! TREAT AS 'RED ALERT'! UNIDENTIFIED SUBMARINE IS AT FOLLOWING POSITION — SAID TO BE FLYING PIRATE COLOURS...

WILL GO! ALL STOPS OUT...!

Two jet-lift VTOL aircraft, piloted by Ben Kidd and Red Morgan, took off from the pirate submarine 'Shark' in the Caribbean Sea. These buccaneer jets intercepted a mystery ship, s.s. 'Alita', which fired on them but was then forced to obey radio instructions. While the 'Shark' sped on its way to capture the ship, American jet fighters had been launched from an aircraft carrier . . .

The naval jets screamed for their prey . . .

CARRIER HAWK TO CHICKS! THERE SHE IS! GET WITH IT — AND LET'S TAKE A LOOK-SEE! DIVE!

Sirens wailed aboard the buccaneer sub . . .

EMERGENCY! EMERGENCY! ALL HATCHES SEALED! TAKE HER DOWN — FAST! LEFT FULL RUDDER! CRASH-DIVE, BUCKOS!

AYE, AYE, BLACKBEARD!

Bow and stern planes bit deep into water. The nuclear sub, despite tons of steel, dived like a minnow . . .

NO TIME TO WARN KIDD AND MORGAN — LET'S HOPE THEY THINK QUICKLY — SWITCH OVER TO SILENT, DEEP RUNNING!

Loss of radio contact with the 'Shark' warned the two buccaneers. Kidd sent his jet shrieking towards the s.s. 'Alita'. . .

MORGAN, MATE — THERE'S TROUBLE! USE THE 'PREY-MARKERS'! QUICK — BEFORE THE LAW GETS ON OUR TAIL!

THE ALITA WON'T GET AWAY!

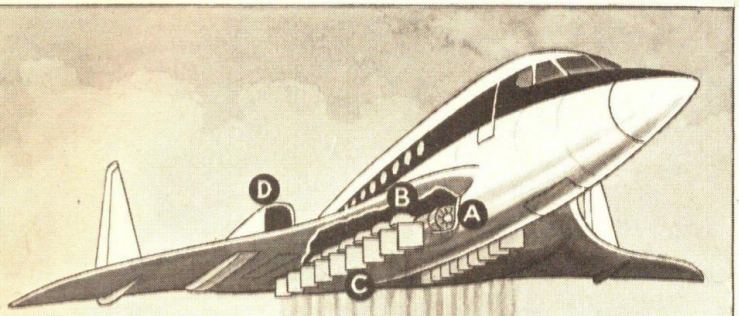
SPECTACULAR WITHOUT BEING DANGEROUS! THE GLARE WILL BE SEEN FOR MILES...

LET 'EM GO, BUCCANEER KIDD!

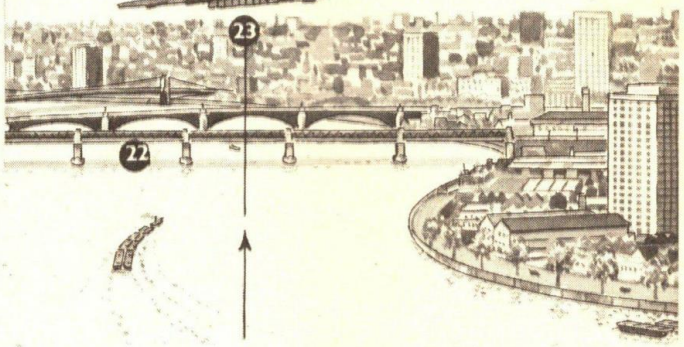
Continued on Page 2

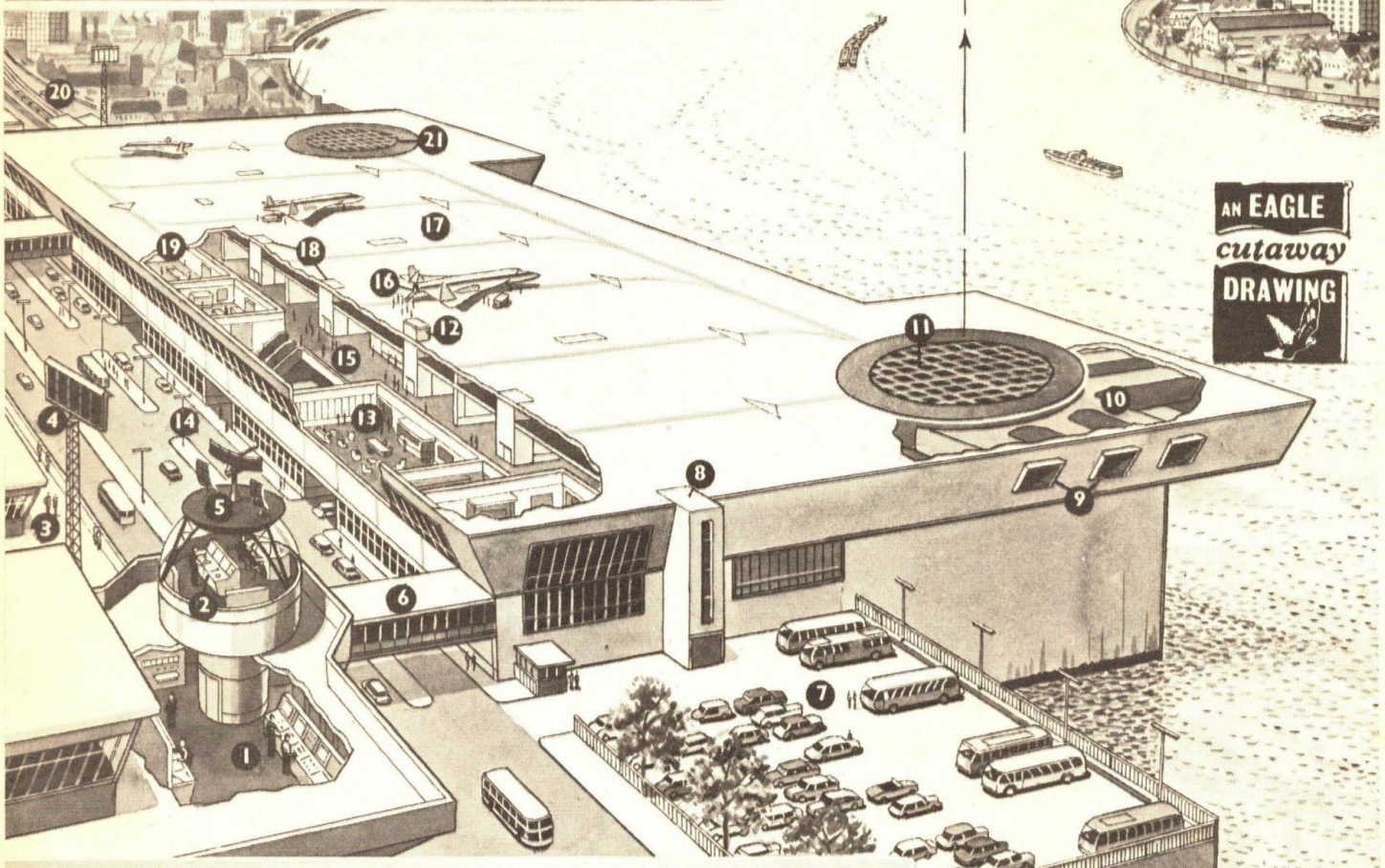
Future Airport In London's Centre

The ever-increasing delays in travelling between existing airports and city centres, like London and Paris, causes a barrier to fast air travel — even if the passenger goes by 600 m.p.h. jet! The answer is vertical take-off and landing (VTOL) airliners which will bring passengers to the city centres. The possibility of an airport site for these VTOL airliners, at Nine Elms on the South bank of the River Thames in the heart of London, has been studied by Hawker Siddeley Aviation. It would be used for inter-city travel, the major airports being utilized for the long-distance supersonic and airbus jets. The big problem for the city centre airport is defeating engine noise; this has brought about a design study for 'quiet' turbofan lift aircraft with wing-mounted lift pods used only during take-off and landing. Separate jet engines will take over for forward power. We show an impression of such a central airport as it might appear in the future with rail and bus services close at hand for reaching offices and hotels in London. The airport would have two separate take-off and landing pads with exhaust noise suppressors and five loading bays.



Proposed design for a 90-seat short-haul transport with wing-mounted lift pods for vertical take-off and landing. (A) Light-weight jet engines for lift. (B) Engine-driven turbofans which give lift and reduce engine noise by lowering the speed of the exhaust gases. (C) Lift ducts can be closed in forward flight. (D) Separate jet engines for forward power.





KEY TO NUMBERED PARTS

(1) Aircraft movement and plotting room. (2) Vertical take-off and landing control tower. (3) Public viewing gallery. (4) Floodlights. (5) Radar scanners. (6) Overbridge from airport offices and communications. (7) Car and coach park. (8) Lift for aircraft refuellers and ground equipment. (9) Take-off exhaust outlets. (10) Exhaust noise suppressors. (11) Take-off pad over the River Thames. (12) Passenger lift raised. (13) Passenger lounge and restaurant. (14) Separate drive in and entrances for passengers and baggage. (15) Main concourse and access to lifts. (16) Rear passenger entry to aircraft. (17) Airport apron with five loading bays. (18) Passenger lifts. (19) Customs and booking office. (20) Existing railway sidings at Nine Elms converted to passenger services to Victoria and Waterloo Stations. (21) Vertical landing pad with exhaust noise suppressers. (22) Victoria railway bridge. (23) Aircraft after vertical take-off transferring to forward flight over the river.

28th JULY, 1990
EVERY MONDAY

TWO NEW PIC-STRIPS START TODAY!

THE NEW Eagle

WIN £10 FOR YOUR DRAWING OF THE FUTURE!

SPAIN 180 Pesetas

45p

STARRING DAN DARE

WOW!

DAN MEETS THE NEW PEABODY!

A NEW SUPER SUPERSONIC!

PLUS! THE MIGHTY MIAMI RACERS!

ISSN 0264-5335

TRANSPORT

'PLANE OF THE FUTURE!

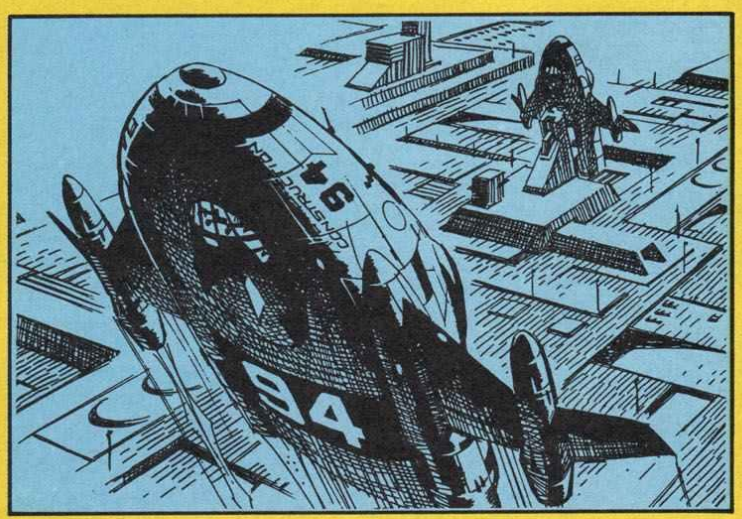
Capitalising on the technological lead achieved in the production of Concorde, British Aerospace has continued to study the possibility of a supersonic successor for the beginning of the 21st century.

Studies are carried out on various sizes of supersonic aircraft from 12-seat business jets upwards, and the design shown here is for a 300-seat, trans-Pacific supersonic airliner which will travel at between two and two-and-a-half times the speed of sound.

DESIGN YOUR OWN 21ST CENTURY AIRCRAFT!

YOU COULD WIN £10!

Pictured above you can see the second generation supersonic airliner that British Aerospace are considering. How about YOU designing a 'plane for the future? It can be any size or shape you want. For one person or a thousand. Your drawings should be in colour, on plain white paper. The sender of the winning design will receive a special £10 prize and EAGLE will send the design to British Aerospace for their comments. If you want to supply any written information with your drawing, it should be on a separate piece of paper. Remember to include your name, age and address and the titles of your three favourite pic-strips in EAGLE. Closing date for entries is August 10th, 1990. *Send to: Plane Design, EAGLE, P.O. Box 67, St. Albans, Herts. AL4 9AG. The Editor's decision on this competition will be final.*



HAPPY BIRTHDAY!

Greetings to **JAMIE DANIELS** of Liverpool, from Mum, brother Michael and all the family. Jamie's birthday is on July 22nd. Birthday good wishes, also, to **JUSTIN HARVEY**, of Kingswood, Bristol. Justin is 10 on 27th July. Last, but not least, a happy birthday to **AARON HAYES**. (We weren't too sure about your surname, Aaron . . . hope we got it right!) Birthday greetings to all EAGLE readers celebrating this week. Remember, if you want any birthday included in this feature, we need two months' notice, due to our early printing schedule. So don't delay . . . write today!

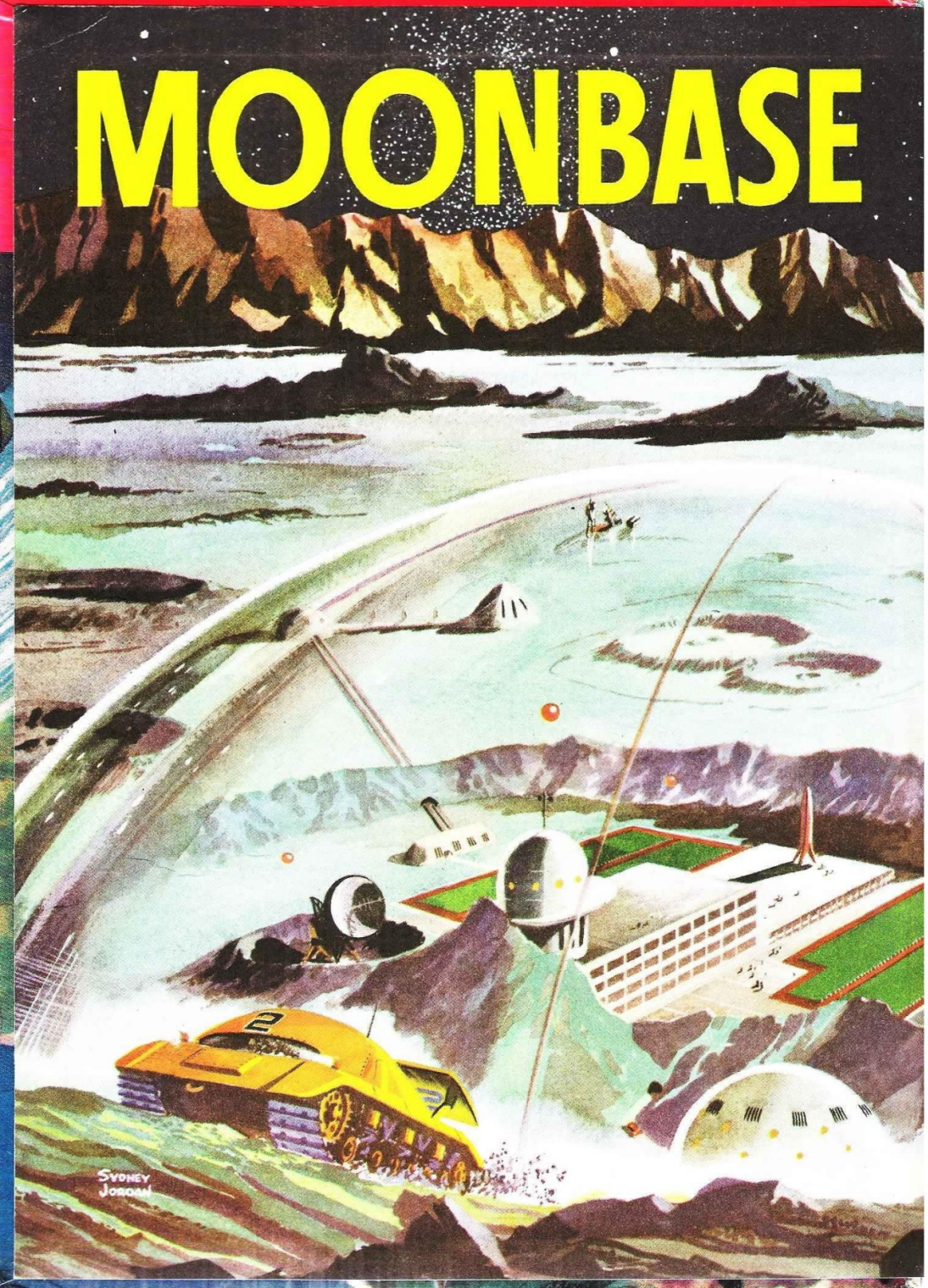
LION

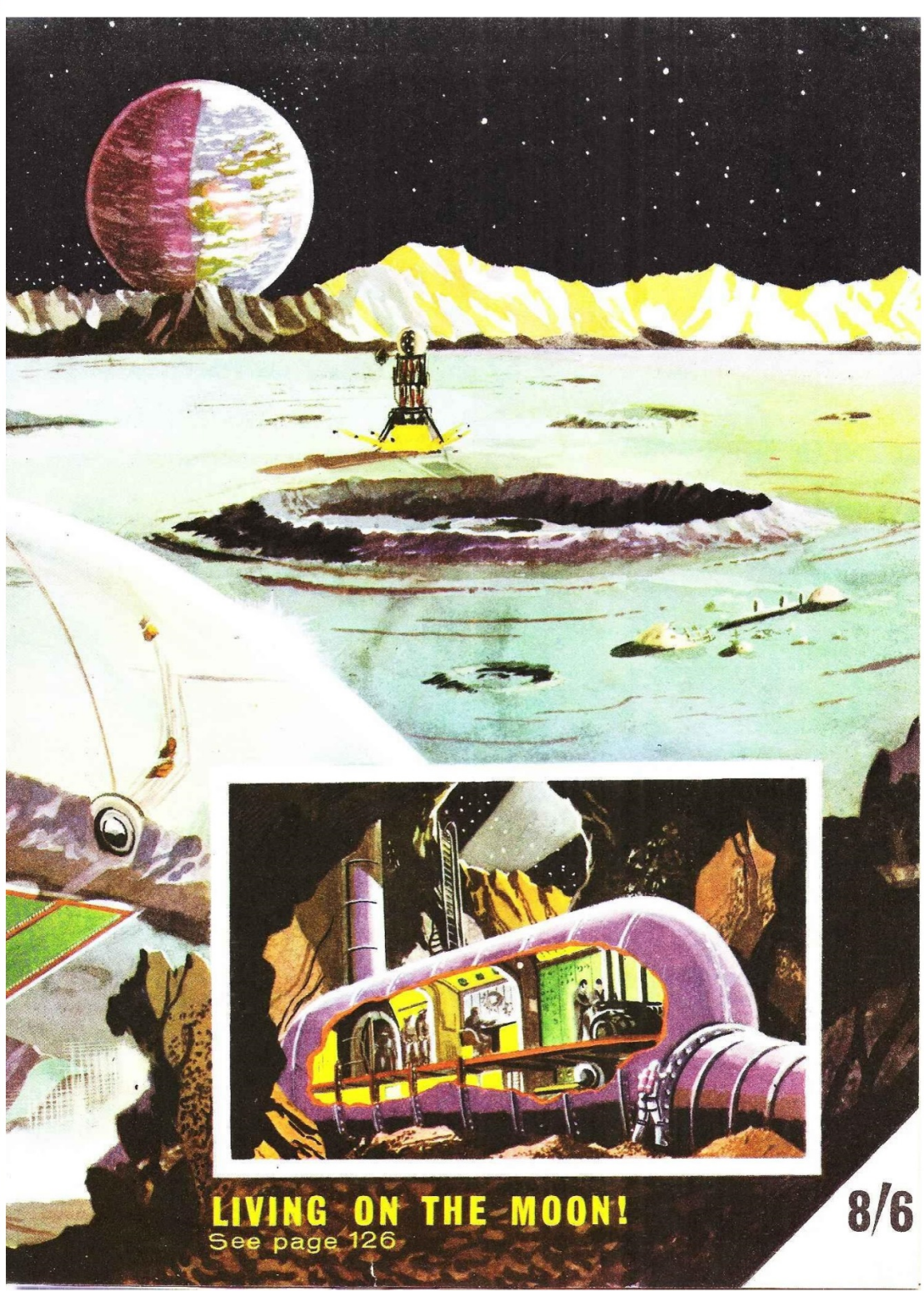
ANNUAL

A FIVE STAR ANNUAL

1963

MOONBASE





LIVING ON THE MOON!

See page 126

8/6

LIVING on the MOON

SOMETIME towards the end of this century, you may find yourself on a super luxury tour of the Moon! The permanent lunar outpost will be the most expensive tourist resort in the history of holidays—a small town built on the barren face of the Moon and, like an iceberg, with most of its area below the surface. The builders will have blown a huge plastic bubble around the Moon-hotel. In this lunar "hot-house" men and plant life will survive in almost Earth-like conditions.

Outside, where the tractors drag the cargo in from the weekly supply ship, the surface temperature at night is minus 240 degrees Farenheit, far colder than any region on Earth. When the two-week-long night ends, the Sun comes up over mountain ranges higher than Everest, and the temperature rises with frightening speed. At "noon" on the two-week-long day it will be over 200 degrees Fahrenheit!

Safe within the air-bubble, the lunar tourist will watch the awesome spectacle of Earth, Sun and stars in their eternal orbits. Earth will cast a greenish light over the lunar plains during the long night.

Fed from artificially-grown vegetables and vitamin concentrates, you may miss the comforts of home. But it will be worth it.

You will have achieved what in your father's time was only a wild dream . . . to set foot on the dust of another world!

MOONBASE KEY:

1. Main control centre and observatory.
2. Hotel-type living area.
3. Hydroponic beds where chemically-produced plants provide food and oxygen.
4. The first Moon-ship—now a memorial.
5. Airlock.
6. Dome for tractors, etc., and air-conditioning plant.
7. Tractor run by hydrogen peroxide turbine.
8. Radio telescope.
9. Atomic pile supplying power to base.
10. Meteorite-strike crew. If a meteorite punctures the dome, one of the floating "balloons" will be sucked to the hole, temporarily sealing it. Crewmen then make a permanent repair.
11. Tractors bringing supplies in from a freighter.
12. Freighter blasting off for Earth.
13. Earth—240,000 miles away.
14. Remains of first lunar base.

INSET KEY:

Here is a sectional view of the system of original living quarters built below ground.

(a) Lift shaft.
(b) Airlock.
(c) Space suits.
(d) Radar remote control panel.
(e) Power plant run from solar mirror on surface.

Living in Outer Space

THE year is 1982 and you are a space engineer on the 200-ft. diameter space station in orbit around the Earth at a height of over 1,000 miles.

Outside the wheel, you are tethered by life-lines, for you may drift from the wheel and have to be picked up by one of the space-boats or "taxis" as spacemen call them.

Within the wheel, the temperature is equalised by the use of shutters in the outer walls. When open they admit a little of the fierce heat on the Sun-side; but in the shadow, where the temperature is below zero, they cool and disperse any excess heat. The walls are treble thick to slow and stop all but the largest meteorites.

The space wheel has a threefold purpose: to survey the Earth and monitor the weather, giving warning of developing storms; to act as a stable observatory—clear of Earth's distorting atmosphere—where the telescope's range and clarity is enormously increased; and to provide an assembly point for the construction of the vast interplanetary exploring ships which will be built in space and which will never actually land on any planet.

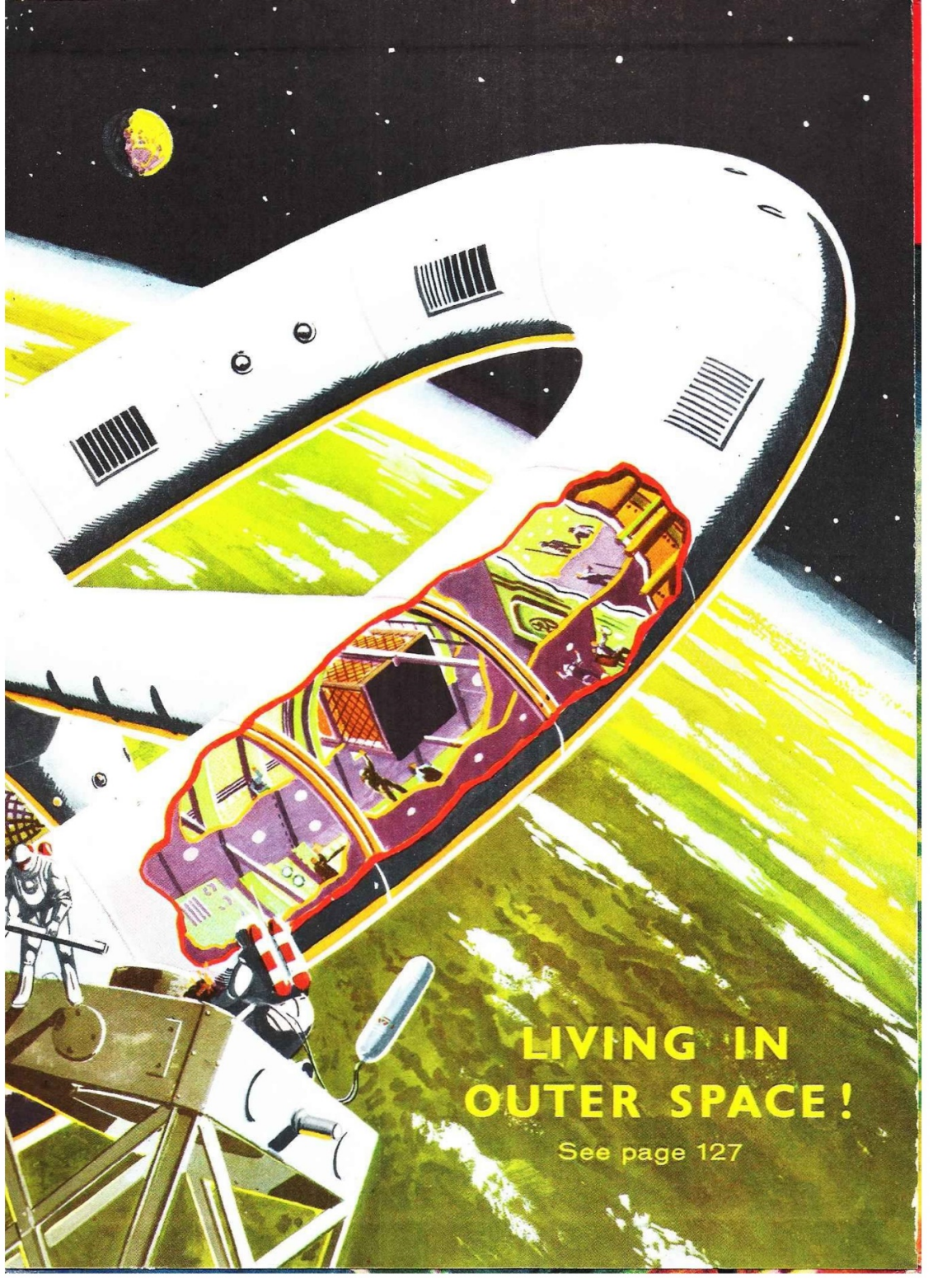
SPACE STATION KEY:

1. Solar boiler. Curved mirror concentrates Sun's rays on mercury-filled pipe. Mercury vaporises, drives turbine for electric power.
2. Airlock for space taxis.
3. Crew airlock.
4. Adjustable shutters for controlling temperature.
5. Radar antennae.
6. Crewman building observatory telescope cage.
7. Space taxi.
8. Supply-ship from Earth built like an aircraft for landing back through the atmosphere.

CUT-AWAY SECTION:

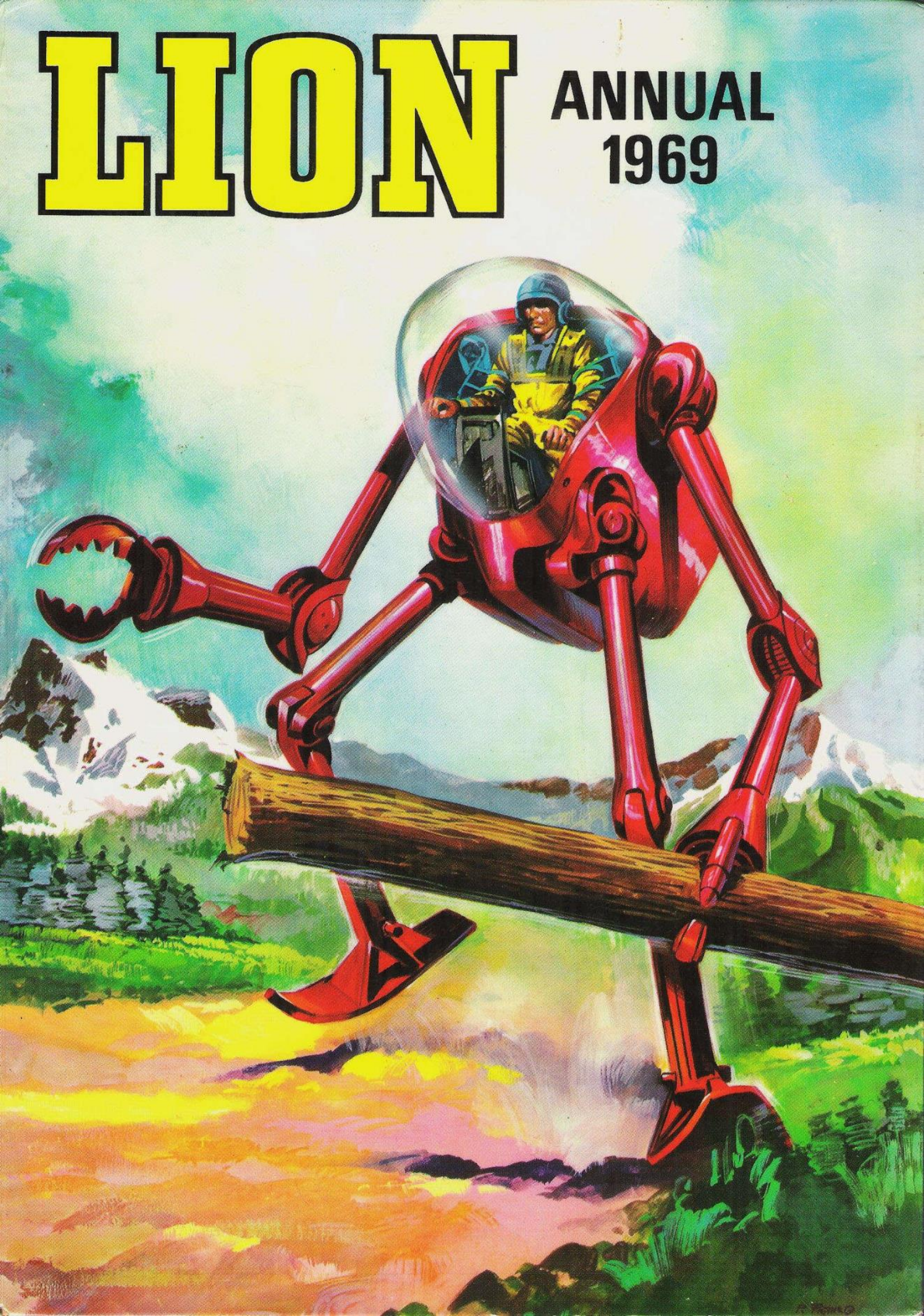
(a) Hoist for transferring supplies from hub to rim.
(b) Three floor levels.
(c) Air-tight door between each section of wheel, in case of meteorite-strike.
(d) Inner skin acting as "meteor bumper."
(e) Power, air, and lighting ducts, etc.

SPACE STATION
SYDNEY JORDAN

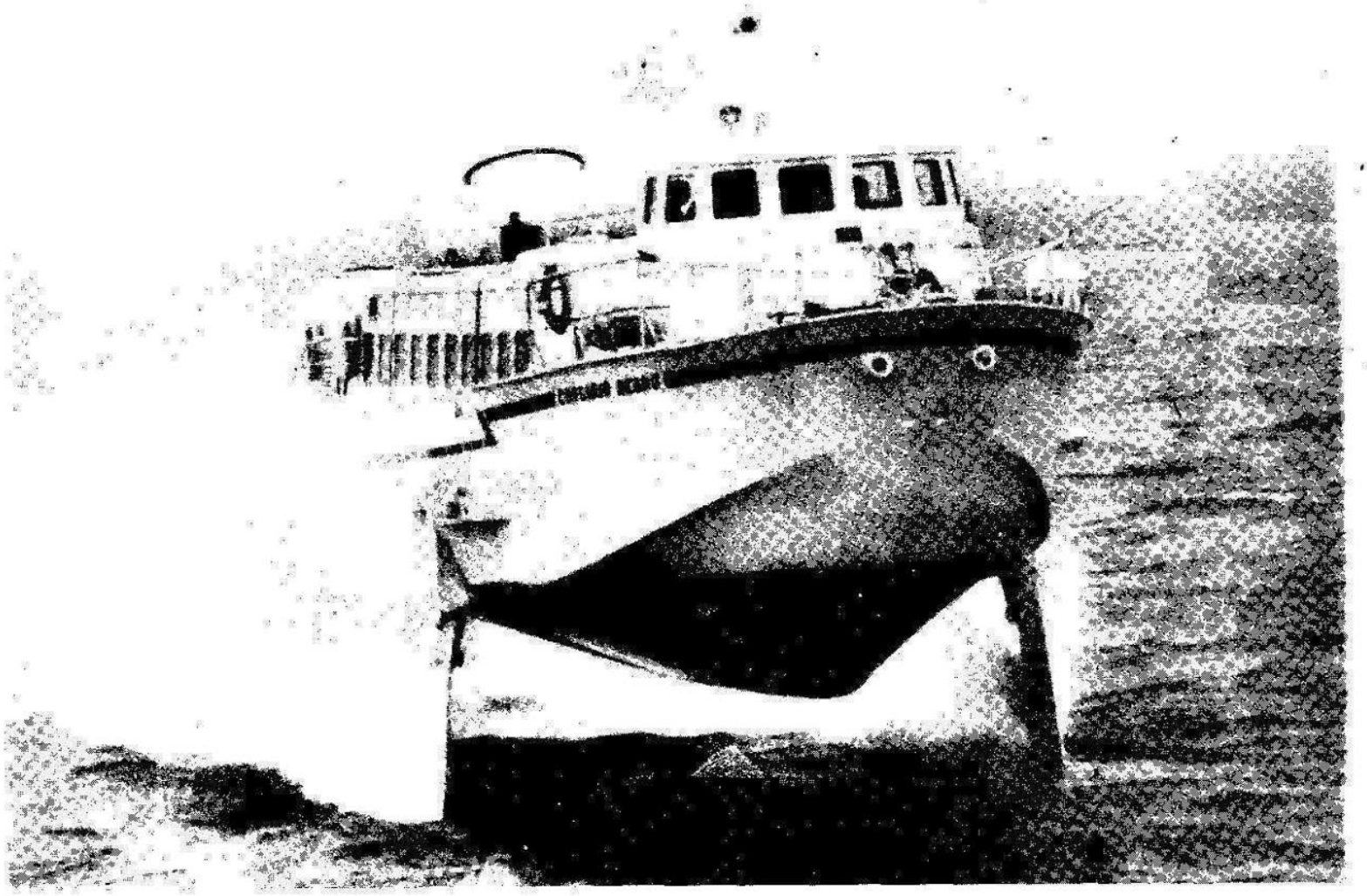

LIVING IN OUTER SPACE!
See page 127

LION

ANNUAL 1969



THE BOAT THAT FLIES



It Skims The Waves At 90 m.p.h.— The Fastest Thing Afloat

AT 50 m.p.h. the high-riding hydrofoil boat skimmed over the placid waters of Lough Neagh in Northern Ireland. This was no high-speed pleasure cruise. The sleek craft was heading for a poachers' boat which, powered by an outboard motor, was trying to escape from the hunting hydrofoil.

Sweeping round the fugitive craft in a tight creaming arc, Captain Barry of the hydrofoil patrol bellowed through a loud hailer, calling for the poachers to heave to. A defiant refusal floated through the air. The hydrofoil moved in closer; a boarding party stood ready to leap into action.

Next instant, a brick flew through the air and shattered the plate glass windshield in front of Captain Barry's face.

The poaching fishermen were not going to submit easily.

Captain Barry had no alternative. "Stand by to ram!" he ordered. The hydrofoil snicked over the

Continued on next page

A miniature hydrofoil craft "takes off", rising on her seawings during a demonstration run on the River Thames. Could it help solve the Capital's growing traffic problems?

water in a wide circle, drummed up full speed and flashed towards the hostile craft.

Seconds later the sharp bows and steel foils of the hurtling "flying" boat sliced into the wooden sides of the poachers' vessel. Nobody was hurt. The poachers, knowing that tough Captain Barry would stop their boat at all cost, had dived overboard before the moment of impact. They were picked up by the hydrofoil crew and taken ashore to face the consequences of their illegal fishing.

It was in 1965 that the Toome Eel Fishery Company, which has exclusive rights to the fishing of Lough Neagh, became so concerned at the alarming, full-scale illegal trawling of eels in the lake, that they decided to reorganise and streamline their existing patrol.

The size of the lake—at 150 square miles the largest in the United Kingdom—presented something of a problem. It was a vast area to patrol; and hundreds of creeks up which the canny poachers could run to safety were too shallow for the normal motor patrol boats to navigate.

The answer to this problem was to get the fastest thing afloat—the hydrofoil: a craft with a shallow draught which can skim, or "fly" across the surface of the water, its hull lifted by wing-like foils that slice through the surface like knives.

Captain Barry, a veteran sea-dog with previous experience of hydrofoils, took command of the two new high-speed patrol boats, which were aided by an Auster spotter plane.

Within a year the sensational hydrofoils had virtually stamped out the illegal fishing which was threatening the eel population of the lake. But it was a hard fight. The "water bailiffs" were faced with shotguns and violence and had been forced to ram three boats.

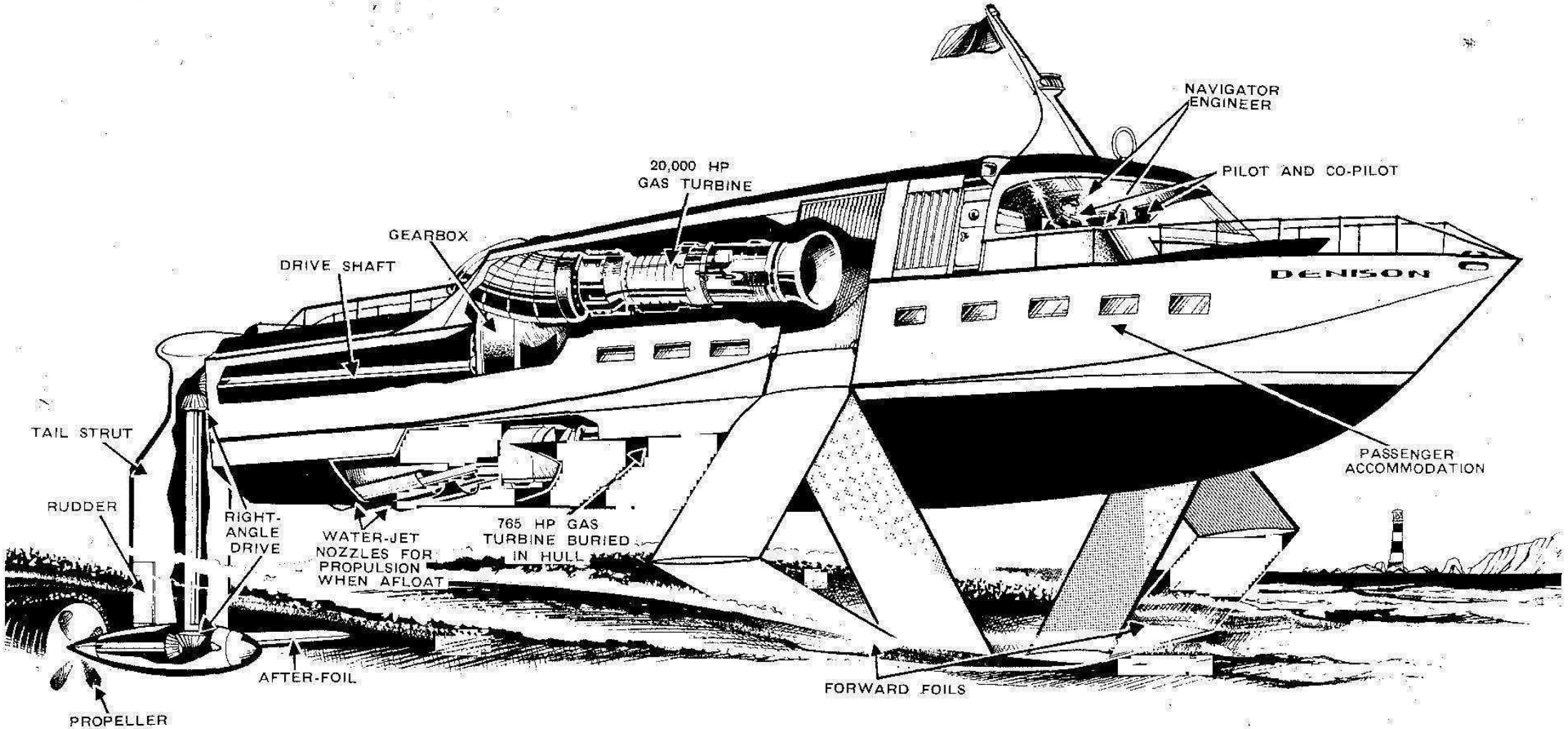
Water-borne fliers

The high-flying hydrofoils are the greyhounds of the sea. They are really ships with "water wings". The same principles of aeroplane flight are applied except that the "wings" move through water instead of air and, once a certain speed is reached, lift the hull clear of the surface.

Thus the dragging effect of friction is greatly reduced and this enables these remarkable vessels to travel two or three times faster on the same power that drives a conventional boat.

In rough water hydrofoil boats behave just like aircraft do in bumpy air. In both cases they have the advantage that the faster they travel the less they are affected by turbulent conditions. A normal boat is

Continued on page 132



DENISON IS RIDING HIGH!

Since great inventor Alexander Graham Bell designed his hydrofoil boat back in 1919, there have been many experiments with these craft.

One test even involved fitting foils to one of the famous war-time Ducks (DUKW's) amphibious vehicles which played such an important part in the Normandy landings and many other Allied operations.

The ungainly Duck, its wheels just brushing the surface of the water, reached an impressive 35 miles per hour on its submerged foils.

Another indication of the spectacular speeds achieved by hydrofoils is provided by the *Denison*, the American foil ship illustrated above. This vessel is designed to cruise at 70 m.p.h., carrying eighty passengers in airliner-type seats within a sound-proofed hull.

The Denison's speed is achieved firstly by the large forward foils which can be retracted for docking, and by the simple over-stern right-angle drive, transferring the mighty engine's 25,000 lb. thrust to the 36-inch propeller.

Our cut-away drawing shows some of the principal features of the *Denison*.

ZIP NOLAN in—

The TRAIL of the STEEL MONSTER

How do you fancy your chances as a detective? There is a clue hidden in this story . . . a clue which helps to pin the crime on one suspect. Highway cop Zip Nolan spots it. See how you make out . . .

ZIP NOLAN, of Pensburgh City Police, was patrolling the roadways of the huge forestry site outside Pensburgh. Everywhere was quiet and deserted; the timber company was trying out a new system of closing down for three weeks, and giving all its men their summer holiday at the same time.

Zip had just made a routine call on his radio-telephone to headquarters. As he slid the receiver back into the socket on his motor-cycle, he glanced round . . . and got the shock of his life!

A huge, gangling skeleton-like monster had loomed out of the trees behind him, shutting out the sunlight. It towered above him, probing forward with its immense arms, like some horror-insect reaching ahead with its antennae—a horror-insect magnified to a million times the normal size!

As the stunned policeman staggered back, he heard the soft whirling sound of motors. The monster suddenly shifted away from Zip, and he watched it cross the roadway with gigantic, dust-raising strides, then amble off up the track into the trees opposite.

Zip chuckled to himself and relaxed. Across the back of the monster's body were painted the words: PENSBURGH TIMBER COMPANY INCORPORATED. This wasn't a demon from outer-space; it was a man-made machine for lifting timber!

Zip mounted his motor-cycle. The monster had disappeared up the track, but he could see the pine trees swaying as it brushed against them. He glanced at his watch. He wasn't due back at the station for another two hours. This monster fascinated him and he decided to have a second look at it. He revved-up his motor-cycle and sent it darting up the side-track.

A moment later he emerged from the track into a broad meadow. In the centre of this stood a big shed, its double-doors swung wide open. As Zip drew closer, he saw that the monster had been driven inside. Almost immediately, a door in the monster's back opened and a lanky, freckle-faced youth threw out a rope ladder and clambered down.

Zip smiled as he recognized Smiley Smith, a boy who had been in trouble with the police until he'd got a job on the forestry site. Zip had helped put him on the right side of the law.

"Hello, Zip," Smiley grinned. "Sorry if I gave you a scare back there."

"That's okay, Smiley," the policeman said. "I thought everybody was on holiday from the timber company."

"Just me and my boss, Mr. Gummer, left behind to keep an eye on things," Smiley replied. "We had to be here to take delivery of this new timber-lifting machine. She's a beauty, isn't she? I couldn't resist giving it a try out."

Zip had dismounted, and he and Smiley stood in the shed doorway looking up at the back of the weird metallic monster, with the name of the timber company painted boldly across it.

"What is it?" Zip asked.

"It's called a pedipulator," the boy said. "In the cab there's a harness. When you put this on, the machine imitates every movement you make. If you reach out and make a grasping movement, the pedipulator does the same. It picks up tree trunks like matchsticks; it can stride over swampy ground,

step over high walls and lift fantastic weights. It can even do demolition work . . . "

" *Come on, Smith! Time you had the machine locked away. You're like a kid with a new toy!*"

The harsh voice quelled Smiley into silence. Both the boy and the policeman whirled towards the brawny, loud-mouthed man who had come up behind them.

" This is Mr. Gummer, the foreman," Smiley stammered . . . " Mr. Gummer, this is Zip Nolan of the Pensburgh Police."

Zip shook the man's reluctant hand, feeling the beefy strength in him. He couldn't help but dislike Gummer; the man had a surly, brutal manner.

" Anyway, we're locking up now," Gummer grunted. " There's no cause for you police to poke your noses in here."

Zip didn't reply. He nodded farewell to Smiley, then mounted his motor-cycle and zoomed off.

" You'll never snoop again, cop! "

CAPTAIN Brinker, head of Pensburgh Police, was red-faced with anger. " This is disastrous!" he bellowed. " I thought we had the best police force in the state . . . and now this happens!"

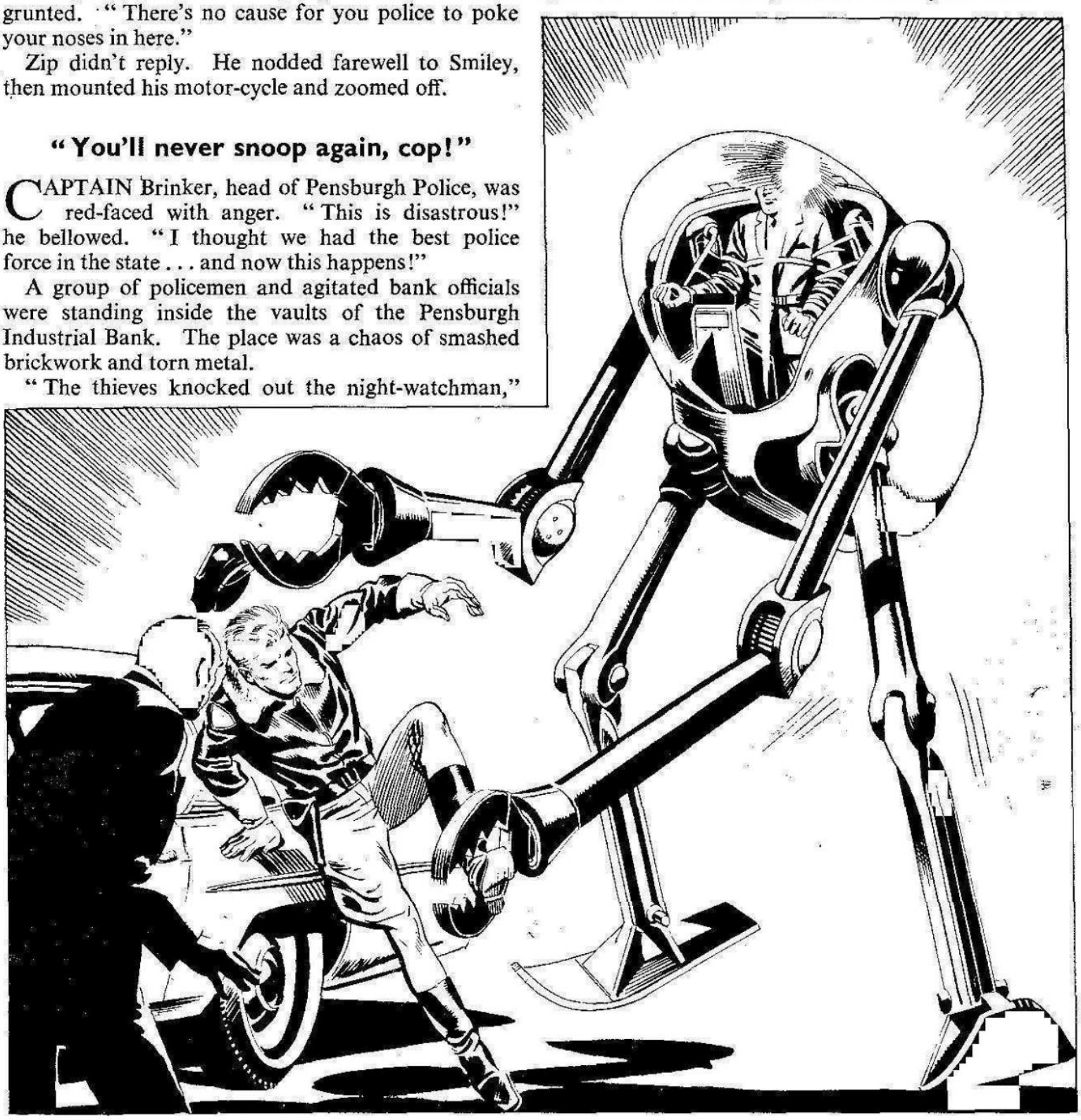
A group of policemen and agitated bank officials were standing inside the vaults of the Pensburgh Industrial Bank. The place was a chaos of smashed brickwork and torn metal.

" The thieves knocked out the night-watchman," the dismayed bank manager explained, " then busted into these vaults. How they did it is a mystery. Look at the way the door has been ripped off. It's as if some giant hand had done the job. Anyway, whoever did it has got away with a fortune."

Captain Brinker scowled, then his gaze switched to Zip Nolan who was peering closely at the wrenched-out vault door. " What are you gawping at, Nolan?" Brinker growled.

Zip straightened up. " I've got a hunch, Captain," he said. " With your permission, I'd like to do a spot of investigating. I'll radio in if I get anything definite."

" I want more than hunches, Nolan," Brinker grunted. " Make sure you don't waste your time!"



Suddenly, the pedipulator came to life. One of its steel claws reached out and grabbed Zip's ankle. The speed-cop found himself being dragged into the air, powerless to resist the strength of the metal monster!

his eyes and grunted with the pain of his bruised body. He sat up and rubbed his shoulder and gradually his senses returned.

" I must've been unconscious for quite a while," he groaned. " What's the time now?"

Smiley glanced at his watch and said, " One o'clock."

Zip's memory was coming back. " Where's Gummer?" he asked. " And that giant muscle-man?"

"Mr. Gummer's disappeared," Smiley said. " I don't know where he's gone. I was looking for him when I found you. I've never seen any muscle-man round here, but Mr. Gummer doesn't tell me everything."

Zip scratched his chin thoughtfully, then he said, " There's only one place a giant like that could have come from. Smiley, is there a circus near here?"

Smiley nodded excitedly. " Sure, Zip . . . over at Crayville. But it finished last night. It should be moving on today. The star of the show was a strong-man called Miller the Mighty. He could be your giant!"

Zip scrambled to his feet, brushing the dust from his uniform. " Is the pedipulator in the shed?" he asked.

" Sure, Zip."

" We're going to need it," Zip said. " Come on, we've got to move mighty fast!" With that he started up the path which led to the cliff-top, the boy rushing along to keep with him.

By the time they reached the shed, Zip had explained all that had happened. Smiley had a key to the shed and soon they had the doors wide open.

" Show me how to work the pedipulator, Smiley," Zip said.

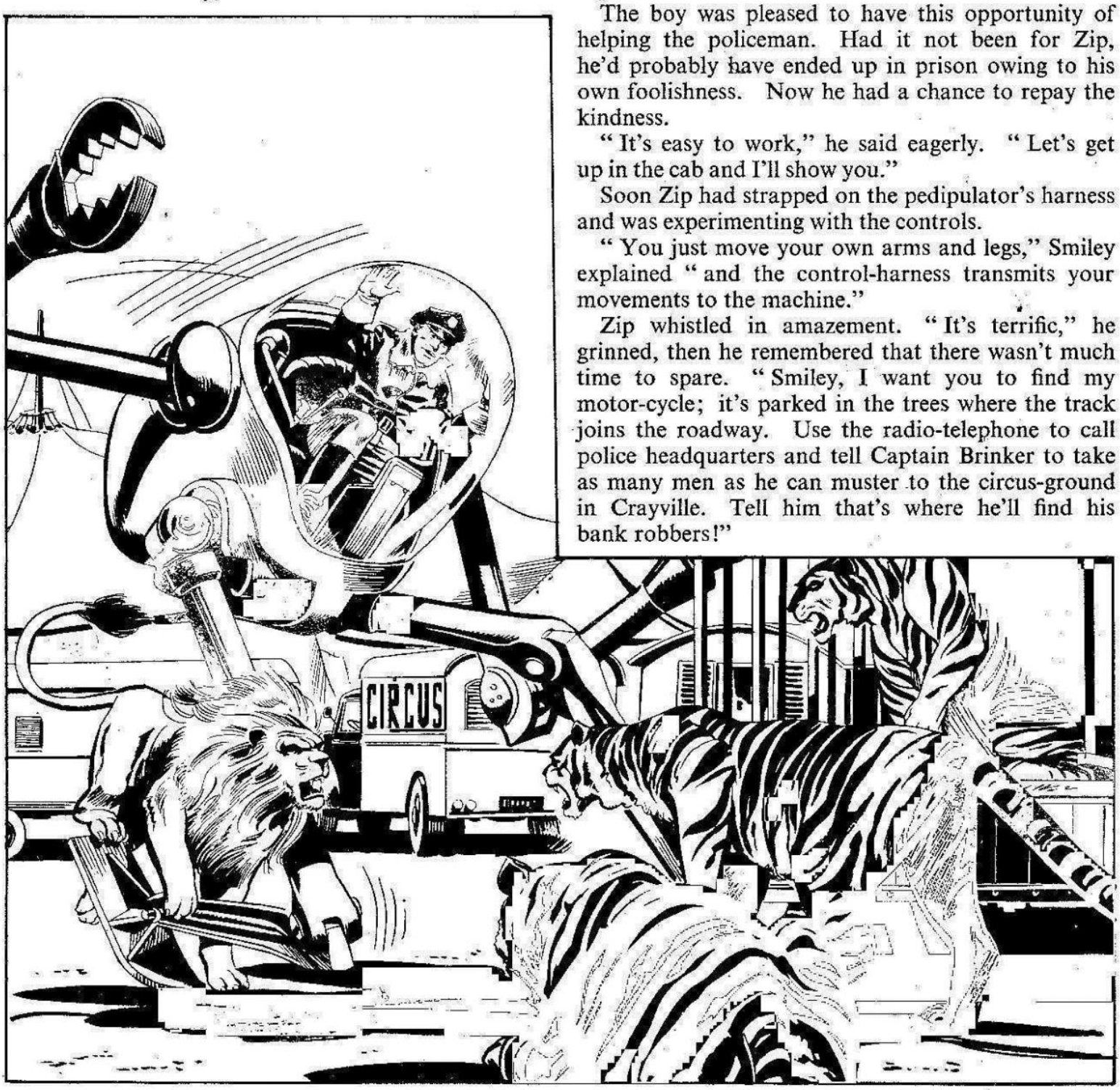
The boy was pleased to have this opportunity of helping the policeman. Had it not been for Zip, he'd probably have ended up in prison owing to his own foolishness. Now he had a chance to repay the kindness.

" It's easy to work," he said eagerly. " Let's get up in the cab and I'll show you."

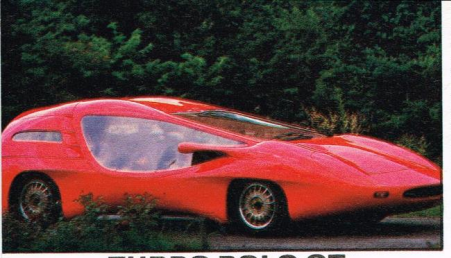
Soon Zip had strapped on the pedipulator's harness and was experimenting with the controls.

" You just move your own arms and legs," Smiley explained " and the control-harness transmits your movements to the machine."

Zip whistled in amazement. " It's terrific," he grinned, then he remembered that there wasn't much time to spare. " Smiley, I want you to find my motor-cycle; it's parked in the trees where the track joins the roadway. Use the radio-telephone to call police headquarters and tell Captain Brinker to take as many men as he can muster to the circus-ground in Crayville. Tell him that's where he'll find his bank robbers!"



The escaped beasts seethed round the pedipulator. A lion snatched at the machine's right leg . . . and Zip felt the mighty steel structure tumbling forward—out of control!



TURBO POLO GT

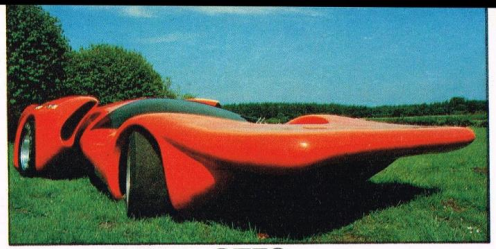
Colani took a standard VW Polo and worked his own special magic on it: new bodywork and turbo-charged engine have transformed the performance, and wind tunnel testing has shown it to have a wind-resistance lower than that of a Porsche 928.

INDY' PORSCHE

In the U.S. Indianapolis 500 motor race, all the corners are in the same direction, so, if you're Colani, you design a car that is purpose-built to turn in one direction only! The driver sits on one side for better weight distribution and the tyres 'lean' to the side.

HYBERBIKE

The exception that proves the rule — although Colani's design trademark is graceful curving lines, his study on a BMW bike has hardly one in sight. Even Colani admits that rules should be broken if the occasion demands!

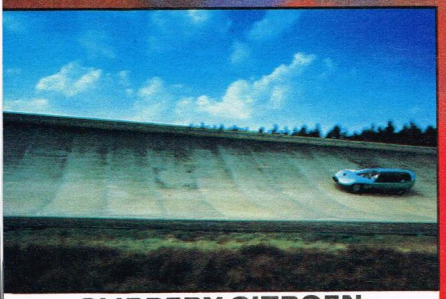


GT70

Not a straight line in sight in this amazing GT70 sportscar! The 'wing' at the nose of the car is practical as well as pretty — it is an inverted aerofoil intended to pull the front of the car down at high speeds for increased stability and roadholding.

2001 JUGGERNAUT

This highly unconventional heavy lorry cabin has three objectives in mind: first, to increase the driver's visibility; second, to improve aerodynamic efficiency; third, to give heavy vehicles a 'friendly' face in contrast to today's 'angry' aggressive driving cabs.



SLIPPERY CITROEN

Colani is always striving to put his novel ideas to practical use: here he is testing a re-bodied Citroen 2CV on a banked circuit in Germany to improve fuel consumption.

AL2 CYCLE-CAR

This is Colani's design study for a combined cycle and car intended for the testing of systems which might help to lessen the effects of the world's fuel crisis.

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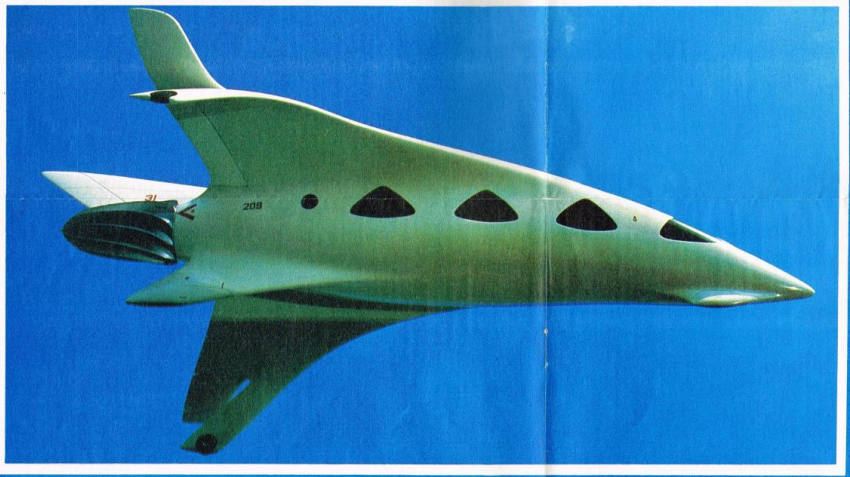
SHAPES OF THINGS TO COME



COLANI VTOL 1: This is Colani's radical proposal for a VTOL (vertical take-off and landing) strike fighter aircraft to supersede the world-beating Harrier 'jump-jet'. Unlike the Harrier, it is capable of supersonic speeds, allowing it to reach trouble spots in the shortest possible time. To achieve this it has a variable geometry wing configuration — in other words, the wings can be swept back for supersonic flight or swept out at right angles to the fuselage for slower speeds, tight turns in dogfights and landings on rough unprepared strips.

ROCKWELL/COLANI BIZ-JET: This is one of the stunning ideas Colani has submitted to the giant American aerospace company, Rockwell International. "Biz-Jets"— short for "business-jets"— are intended to whisk high-powered business executives from one destination to another with the minimum inconvenience, doing away with time-consuming scheduled airline connections.

To avoid the cost and complexity of a retractable main undercarriage, Colani has extended the tips of each wing down to ground level, where there is a small fixed wheel. The nose wheel, however, folds neatly up into the forward fuselage and is covered by a small door.

The interesting 'triangular' cabin windows were inspired by the French-built Caravelle airliner of the 1950s, though Colani has accentuated this shape to its futuristic extreme.

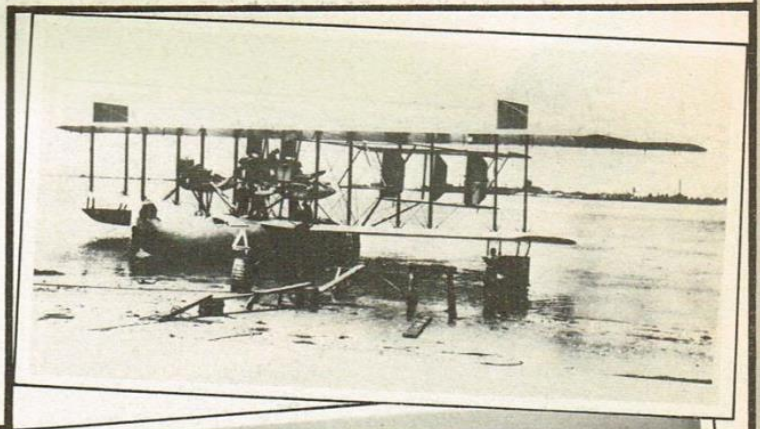
NASA/COLANI HEAVY TRANSPORT: In recent years, this has been one of Colani's most exciting projects. He has long believed that the ever-worsening fuel crisis would force propellers back into favour with aircraft designers at the expense of the thirsty turbojet. The new generation of propellers would incorporate the very latest technology and would reflect recent advances in our understanding of aerodynamics. Huge scythe-like blades scoop up the passing airflow and accelerate it to supersonic speed as it flows across each vast spinning surface, providing an enormous pushing force with minimum air resistance.

Along the aeroplane's keel and along the lower edge of the two huge fins protruding from the underside are dozens of wheels with low-pressure tyres to make it easy to operate from rough airstrips.

THE FLYING-BOAT... YESTERDAY'S PLANE TOMORROW?

Friday, August 6th, 1982: a large four-engined aircraft comes down in the middle of London. But there is no panic, all goes as planned with plane and passengers landing safely on the River Thames . . . for this is a Sunderland flying-boat.

It is here to aid the South Atlantic Fund, yet it is also remembered for its own past, its legendary role in World War II. The re-appearance of the almost forgotten plane, raises an old question:

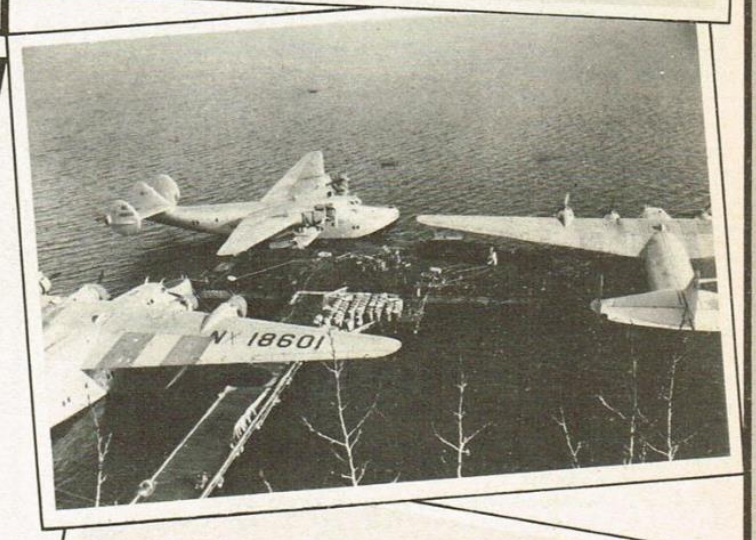


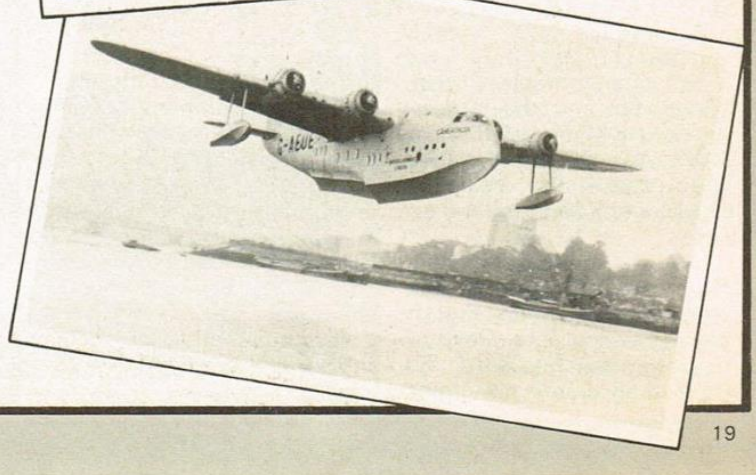
WHY DID THE FLYING-BOATS DIE OUT?

Flying boats once led the world in long-range engine development — the first aircraft across the Atlantic was the Curtis NC-4, seen top right. The pre-war public also loved the idea of an aircraft which could safely put down on water in an emergency. Airlines preferred the cheapness of developing existing harbour facilities as opposed to constructing vast inland concrete runways. In the late 1930s, boats like the Boeing Clipper, centre right, and the Imperial Airways 'C' types, bottom right, were the ultimate in high-technology for hauling people over vast distances in the air.

Anyone looking into the future from those early days could be forgiven for thinking that the future of long-range air transport was inevitably linked with the great, graceful shapes of flying boats. But it didn't happen. The biggest reason that we now whizz around the world in land planes has its roots in World War Two.

War created a new chapter in the history of the military flying boat. The Sunderland boat entered service in 1938 and came into its own in the Coastal Command role. Nicknamed Stachelschwein (porcupine) by the Germans after its bristling defensive machine guns, it was also much feared by U-boat skippers — one U-boat actually surrendered to a Sunderland after a long and bloody running battle.





PRINCESS - LAST OF THE GREAT FLYING-BOATS

Top: The Martin 'China Clipper', which established incredible standards of luxury, safety and punctuality in its trans-Pacific service in the '30s.
Above: A war-time Sunderland carves a creamy wake as she starts her take-off run.

The most notable British flying boat and the largest standard RAF aircraft during WW2 was the Sunderland. Then came the Walrus, which operated from land or water.

Some civilian services also operated during the war, although most aircraft were pressed into Government service. But WW2 did more than create new roles for the flying boat. It also created a completely new aircraft: the heavyweight, long-range land bomber. The bravery of the bomber crews is a fact of history. Almost every bomber in history has been nicknamed the 'flying coffin' but one thing is certain — bombers created the coffin for the flying boats which thus became obsolete.

PEACEFUL USE OF BOMBERS IS THE DEATH KNELL!

MASS BOMBER

The Superfortress and its successors had their origin in the Flying Fortress, which was known to the US Army as B-17 and to the RAF as Fortress. This, and later types, formed the backbone of US bomber strength, especially in mass daylight raids on Germany.

Each Fortress had 12 machine guns and a bomb load of 6,000 pounds.

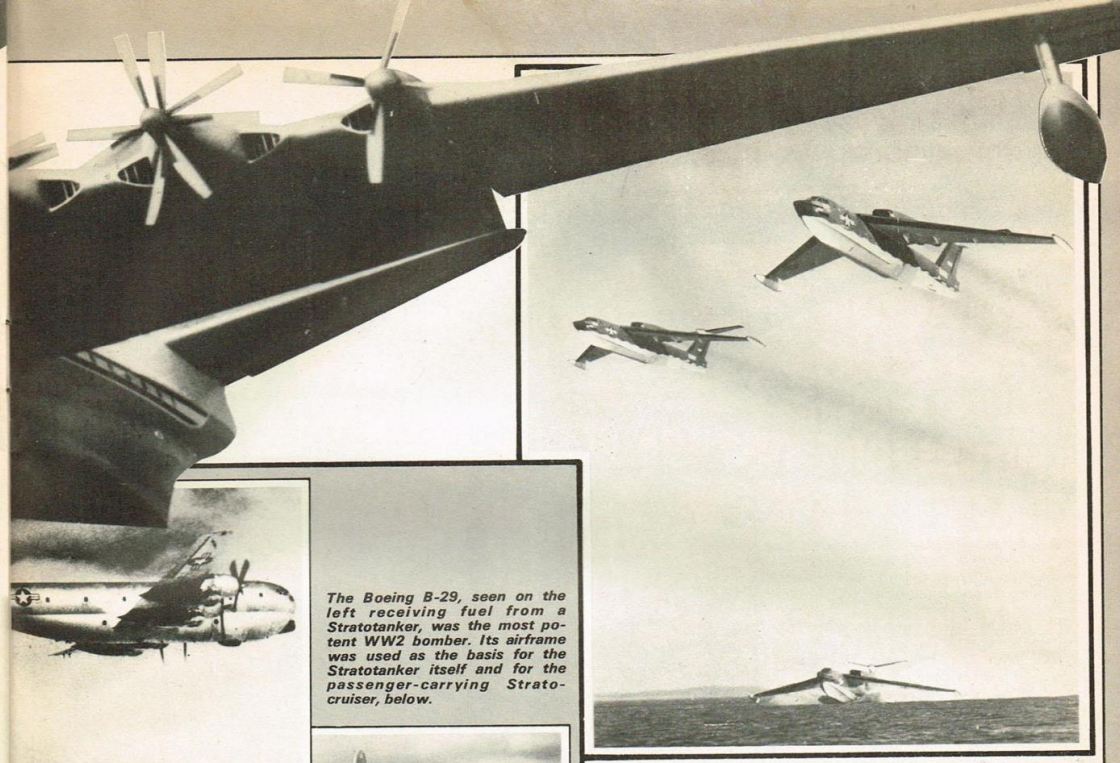
If one land-based aircraft is responsible for the death of the big boats it must be the Boeing B-29 Superfortress.

After the war, the Americans were left with an immense number of B-29 aircraft for which they had no use. Boeing came up with an idea for using these airframes by turning them into airliners. The result was the Boeing Stratocruiser. And, suddenly, the skies of the late '40s and early '50s were full of great 'double-bubble' Stratocruiser fuselages.

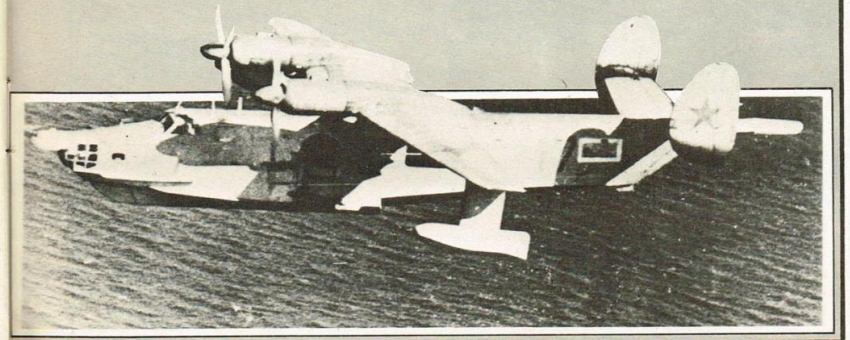
Also, in addition to sparking off the building of a large number of land-planes, the war had caused many large concrete airfields to be built — a good proportion of them were close to capital cities and hence made the coastal ports necessary to flying boats seem unattractive.

By 1949, virtually all military and commercial emphasis was on land-based aircraft. The last RAF Sunderland was hauled out of the water in 1955, although some airforces continued using her until the middle '60s.

Today, the only regular use of flying boats (as distinct from the much smaller float-planes) is made by Russia with the Beriev patrol aircraft, bottom right, and by Japan, which uses the Shin Meiwa, bottom left, in the anti-submarine role.



The Boeing B-29, seen on the left receiving fuel from a Stratotanker, was the most potent WW2 bomber. Its airframe was used as the basis for the Stratotanker itself and for the passenger-carrying Stratocruiser, below.

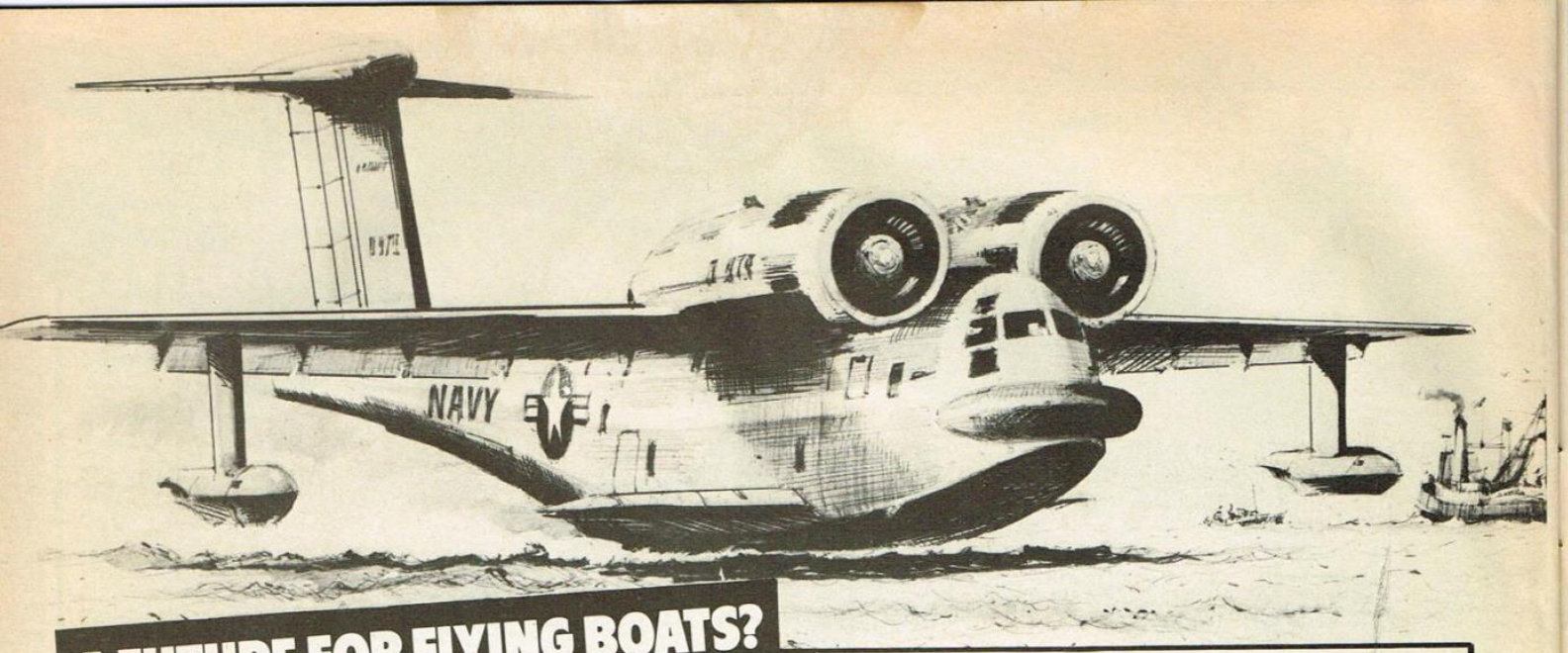


Before the majestic profiles of the sea-borne giants vanished from the skies, there were a number of projects which put INTO the skies shapes which had never been seen before and have not been equalled since. One such project was the British Princess boat seen across the top of the page. Conceived as the ultimate in trans-Atlantic air travel, three prototypes of the Princess were built. She was massively stable in the air and, in fact, contributed greatly to later aerospace developments by pioneering the use of some very new technology. 'Fly-by-wire' techniques (using electrically controlled guidance surfaces) are only starting to enter service today, yet the Princess pioneered them.

PACIFIC PATROLLER

Another boat, the US Navy's jet-powered SeaMaster, seen above in a noisy formation take-off, actually entered service as a Pacific patrol aircraft after a long and difficult development period. The SeaMaster was never fully successful in service — perhaps it was trying to do something that a flying boat just could not do.

On the other hand, perhaps it was just many years ahead of its time . . . have a look over the page and see what we mean . . .

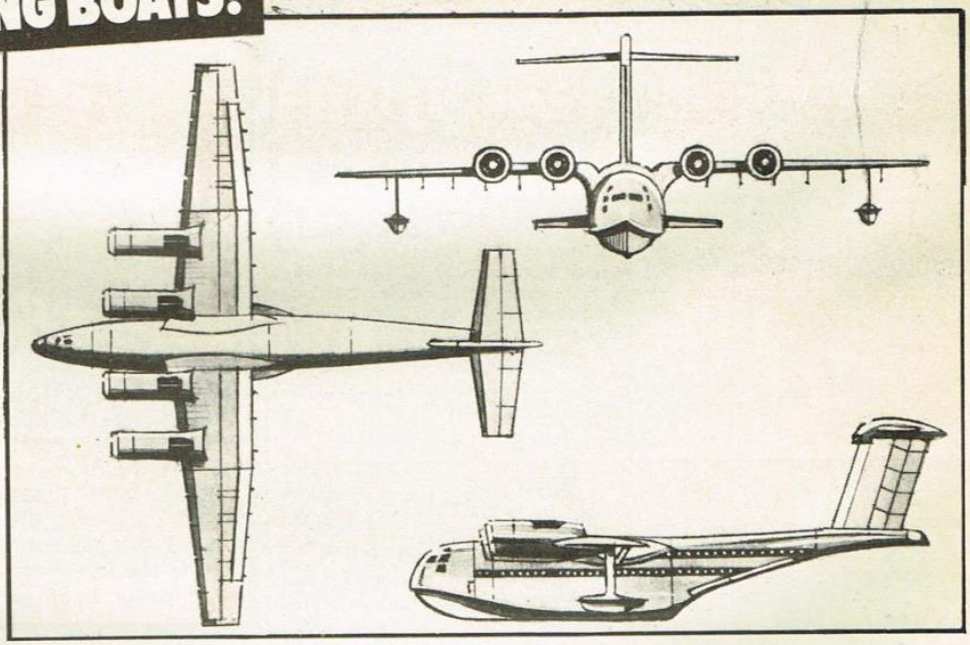


A FUTURE FOR FLYING BOATS?

IF 'new-technology' flying-boats had been in the air over the Falklands, it's possible they could have saved lives. A medium-sized boat, like that shown here, could have been designed as a flying airborne early warning (AEW) aircraft and could have given in-depth warning of Argentine attacks.

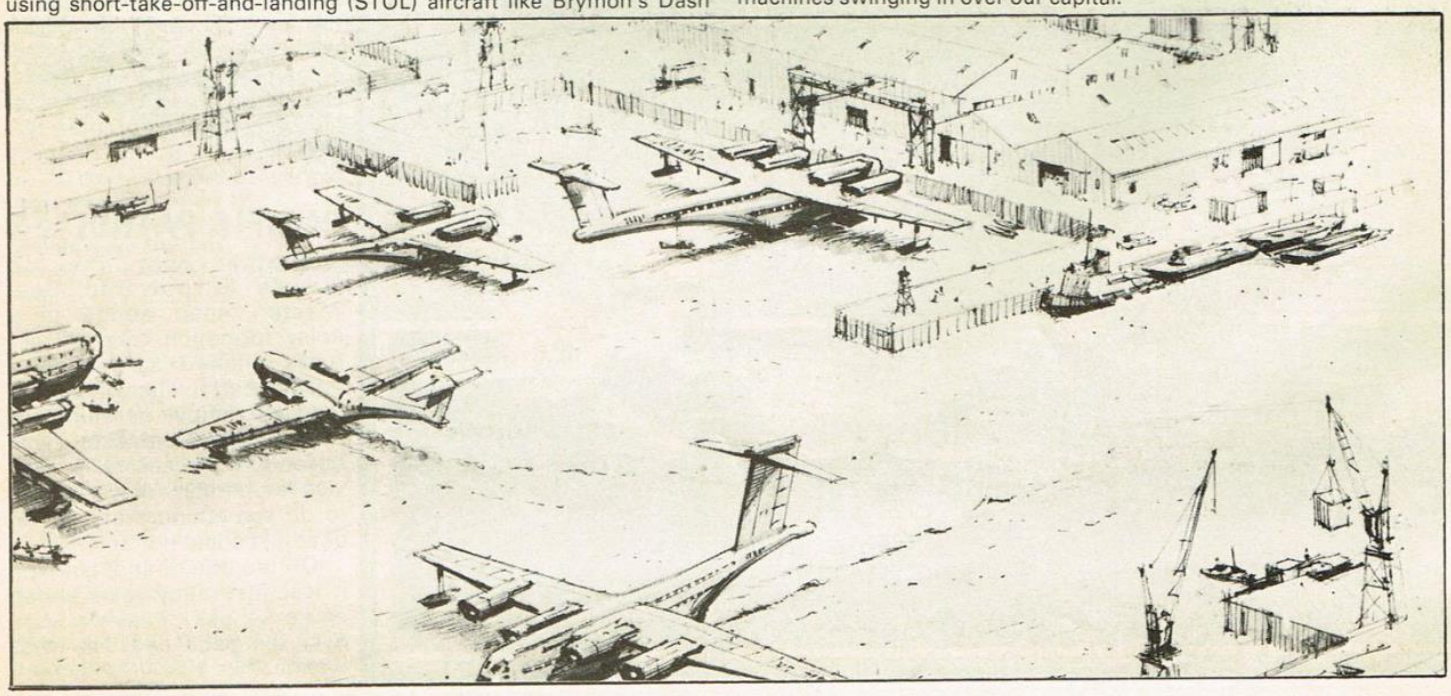
The design we have illustrated here features a high-lift wing and engines to facilitate short take-offs and landings. She could have been refuelled at sea from ships.

But what about the commercial applications for the flying boat? Using the same principles as our AEW study, the large commercial passenger transport shown right, could land in very short distances indeed and so, should we ask . . .



IS THIS LONDON'S THIRD AIRPORT?

London's developing docklands could possibly provide a custom-made landing and docking strip for a new generation of flying boats. Plans are already afoot to use part of the dock basins for a Stolport using short-take-off-and-landing (STOL) aircraft like Brymon's Dash 7's. But if British Aerospace were to develop a Stol flying boat (a development which is unfortunately unlikely because of the high cost) then we could once again thrill to the majestic shapes of these great machines swinging in over our capital.



ONE JUMP BEHIND

THE UPS AND DOWNS OF VERTICAL TAKE-OFF

Where are the VTOL airlines?

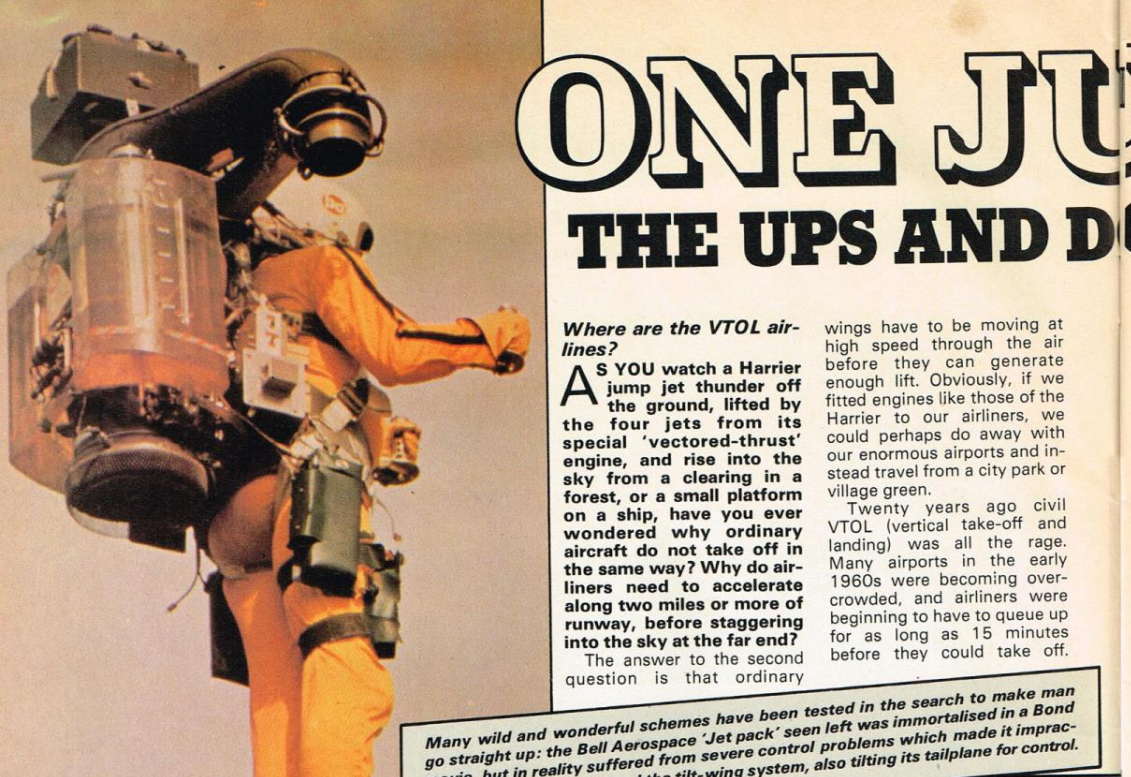
AS YOU watch a Harrier jump jet thunder off the ground, lifted by the four jets from its special 'vectored-thrust' engine, and rise into the sky from a clearing in a forest, or a small platform on a ship, have you ever wondered why ordinary aircraft do not take off in the same way? Why do airliners need to accelerate along two miles or more of runway, before staggering into the sky at the far end?

The answer to the second question is that ordinary wings have to be moving at high speed through the air before they can generate enough lift. Obviously, if we fitted engines like those of the Harrier to our airliners, we could perhaps do away with our enormous airports and instead travel from a city park or village green.

Twenty years ago civil VTOL (vertical take-off and landing) was all the rage. Many airports in the early 1960s were becoming overcrowded, and airliners were beginning to have to queue up for as long as 15 minutes before they could take off. Their captains eagerly looked forward to the day when there would be no more queues; instead, they dreamed, they would open the throttle and go straight up into the sky, like a Harrier.

Some companies built aircraft that were a cross between a helicopter and a turboprop airliner. Britain's Westland Rotodyne took off vertically like a monster helicopter, with up to 60 passengers or bulky cargo on board, and then transformed itself into a high-speed turboprop with normal propellers, wings and flight controls. In Germany the Dornier company actually flew a number of research prototypes with a transport fuselage lifted by two Harrier engines. These Do 31s were the only jet-lift transports actually to fly, but almost every aircraft company worked on the problem.

Just look at the projects studied by one company alone, Britain's Hawker Siddeley (now British Aerospace): *H.S.129,* high-wing military transport with two Harrier engines plus extra jet-lift engines in underwing pods; *HS.133,* a 100-seat airliner with a wing like Concorde and special *RB.202* fan-lift engines in fairings along the fuselage; *HS.139,* a civil 100-seater based on the 129; *HS.140,* a five-seat research aircraft with one lift fan; *HS.141,* a 100-seat airliner with a sweptback low-mounted wing and 16 RB.202 lift fans (an immense amount of work was done on this); *HS.145,* a business jet with small lift fans; *HS.681,* a large transport for the RAF to support VTOL combat squadrons, with four vectored main engines plus lift-jet pods; *HS.803,* an 80-seater with circulation-controlled rotors (a British invention of a helicopter rotor that could be stopped and folded after takeoff) and rear-mounted jets for high-speed flight with ▶

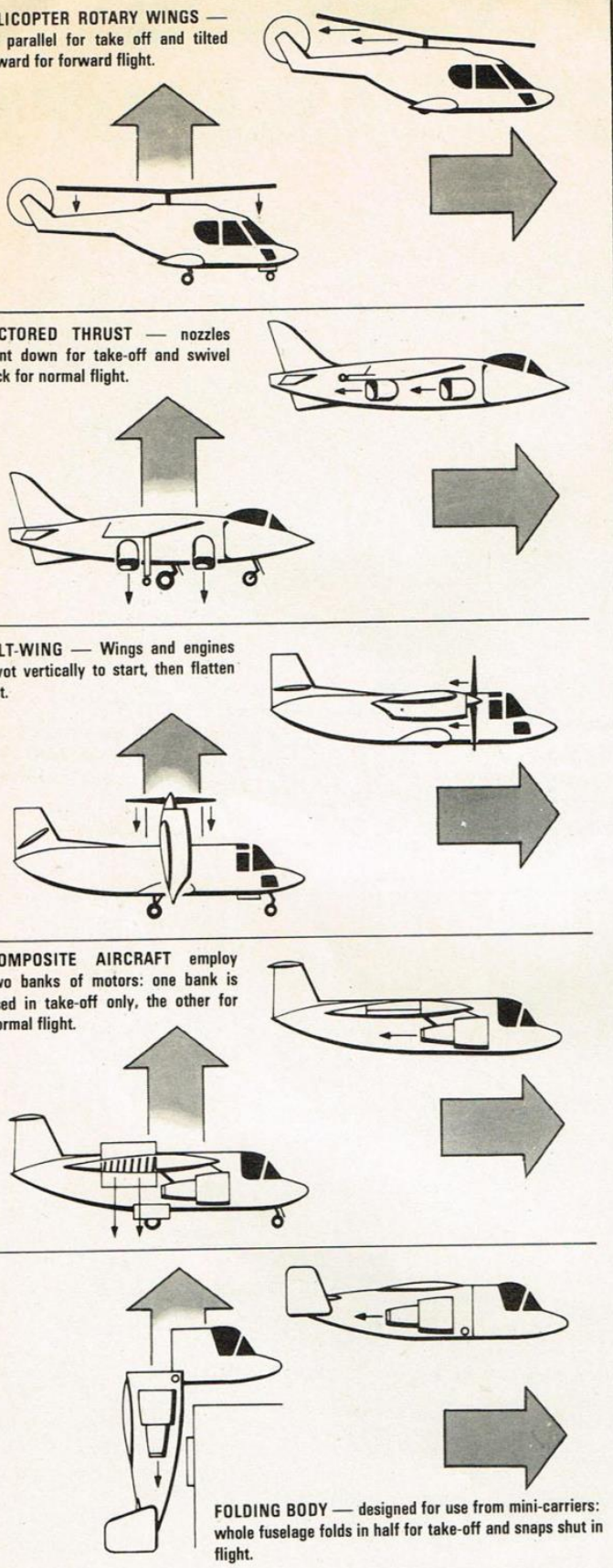


Many wild and wonderful schemes have been tested in the search to make man go straight up: the Bell Aerospace 'Jet pack' seen left was immortalised in a Bond movie, but in reality suffered from severe control problems which made it impractical. The CL-84 below used the tilt-wing system, also tilting its tailplane for control.

The Vought-Hiller-Ryan XC-142A seen above, also used the tilt-wing system. Powered by four turboprop engines, it flew for the first time in 1964. Designed as a battlefield transport the XC-142A was capable of carrying 32 fully-equipped troops at a cruising speed of 483 kph.

Powered by two Rolls Royce Dart turboprops, the Fairey Rotodyne, above, was the aircraft which was going to revolutionise inter-city transport in the 1960's. Noise and cost considerations killed the project, which used the novel idea of bleeding exhaust gas from its forward thrust engines to power the rotor.

THE MAIN VTOL SYSTEMS:



HELICOPTER ROTARY WINGS — are parallel for take off and tilted forward for forward flight.

VECTORED THRUST — nozzles point down for take-off and swivel back for normal flight.

TILT-WING — Wings and engines pivot vertically to start, then flatten out.

COMPOSITE AIRCRAFT employ two banks of motors: one bank is used in take-off only, the other for normal flight.

FOLDING BODY — designed for use from mini-carriers: whole fuselage folds in half for take-off and snaps shut in flight.

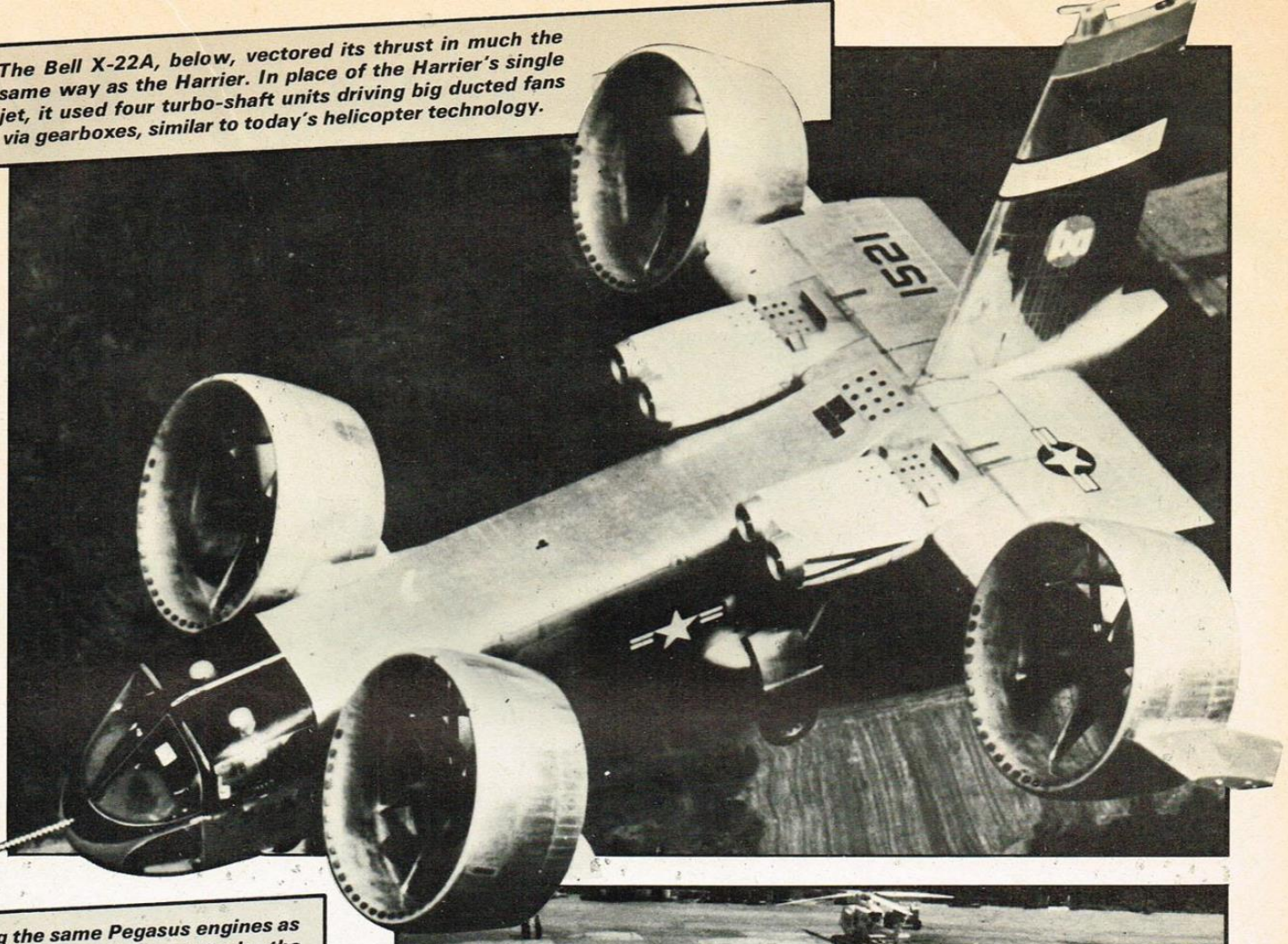
The XFV-1 above and XFY-1 below were two early attempts at a VTOL fighter. Transition from vertical to horizontal flight proved too difficult for them.

ONE JUMP BEHIND

a normal wing; *HS.807*, a business jet with lift-jet pods; and the HS.810, a 100-seater with a circulation-controlled rotor on each wingtrap.

Every one of these projects could have been designed, built and developed to the point at which it could go into service. So what happened to prevent them from ever being more than ideas on paper?

The crucial factor was cost. If you thunder down a long runway you can make your airliner very efficient during the rest of each flight. It can fly at high speed while burning the smallest possible amount of fuel. The jet-VTOL may actually need less fuel to rise into the air, but during the rest of its journey it will be less efficient, burdened by the



The Bell X-22A, below, vectored its thrust in much the same way as the Harrier. In place of the Harrier's single jet, it used four turbo-shaft units driving big ducted fans via gearboxes, similar to today's helicopter technology.

Using the same Pegasus engines as the Harrier on its inner pods, the Dornier Do31, below, also ran a battery of SIX vertical lift engines in outer pods. Whilst flown from 1964 onwards, the Do31 could not achieve the range and payloads needed for a transport.

Now that the Harrier has proved that VTOL technology does work, many aircraft manufacturers are re-activating their interest in the field. The most promising American project is this Bell XV-15, shown here.

jet-lift engines (which have to be enormously powerful to lift it straight up), and the overall costs may be twice those of ordinary long-runway aircraft.

Another factor was noise. If you have listened to a hovering Harrier you can imagine what a jet-lift airliner would sound like! The passengers would not notice, but those on the ground would!

A third reason for non-appearance of the vertical-rising airliner is that the airlines are extremely cautious. They simply hate anything new. Even if it comes from a company they know, they really prefer to stick with the old proven aircraft.

Civil VTOL could hardly be a more radical idea. It's a great idea on paper, and passengers might love it, but for the moment we have to stick with those two-mile runways. ●

COULD YOU DO BETTER . . .?

WELL you've now seen the many different ideas which aerospace companies have tried to make their aircraft jump into the air. Some actually work, some were good ideas which didn't work out and some were downright dangerous. Do you think you can come up with anything better? If so, drop us a line with your designs — we'll print the best and pay for them too. Write to Look Alive, 'One Jump Behind', IPC Magazines Ltd., Room 2631, King's Reach Tower, Stamford Street, London, SE1 9LS.

FLYING CARS

The Ave Mizar was a Ford Pinto and Cessna Skymaster. It spanned 38 ft. 2 in. (approx. 11 metres) and was 28 ft. 6 in. (about 8 metres) long. Level air speed was 156 mph (250 kmh.) with a ceiling of 12,000 ft. (3657 metres). Landing run for the vehicle was 475 ft. (143 metres). The Pinto was standard, with four seats.

With wings folded, this Autoplane could touch 60 mph (96 kmh.) on the road and 90 mph (144 kmh.) as an aircraft, powered by a pusher aero engine. Built in America in the 1950s, it cost around £500.

From experience with his Aerocar range, US designer Moulton Taylor has projected this neat "homebuilt" Aerocar Imp, which is more aircraft than car.

How often have we sat in a long traffic queue, wishing our cars could sprout wings and fly? In America, a number of enterprising men have tried just that and married a car to an aeroplane!

IN RECENT years, there have been only a handful of flying car designs that have worked efficiently; the problem is to build a vehicle that has a good performance in the air *and* on the ground. One American has been working on his aerial car for no less than 26 years!

As you can see, most of the flying cars are completely original designs rather than a mating of standard aircraft and automobile parts.

The reason for this is that, of course, neither machine is built to do the job the flying car men want!

Recently, however, Advanced Vehicle Engineers of America put together a sleek Ford Pinto and the wings and tail booms of the Cessna Skymaster. The pusher engine of the aircraft was attached to the back of the road vehicle, which used its standard engine when on the ground.

Unfortunately, the Mizar, as this design was called, crashed, killing the man whose brainchild it was.

In these days of ever-rising fuel costs, we may yet see a successful car-cum-aeroplane take to the skies and be economical enough to enjoy high sales, but there are a number of problems to be overcome before such a startling idea becomes reality.

Above: Since 1948 the Aerocar company has been working on the flying car idea. This one is the Model III with a custom body shell.

Although not the prettiest aerial car, the Fulton Airphibian was another 1940s design. It flew at 110 mph (177 kmh.) and had a range of 350 miles (563 km.) as a plane. One person could convert it to a car in just seven minutes.

THE FIRST SPACE-AGE WEEKLY

A 'News of the World' Publication.

Week Ending 21st April, 1956. No. 1.

4½D

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

CAPT. FALCON, CHIEF OF THE MOON-BASE PATROL, TAKES OVER THE "HAWKINS" — A NEW SPACE RANGER. MEANWHILE ONE OF THE MOON-BASE PATROL SHIPS IS BEING ATTACKED BY AN UNKNOWN ENEMY....

NEWS OF OTHER WORLDS

Photo by HUBERT HUGGETT

PLASTIC MOON to CIRCLE THE EARTH

Here is the inside story of what the world's first artificial satellites may look like—and the jobs they may do in space

by HERBERT O. JOHANSEN

SOME day within the next two years, as you look towards the horizon in the darkness before dawn or after dusk, you may see a faint spot of light moving swiftly across a moonless, star-studded sky. It will be man's first milestone in space—an artificial satellite, an earth-born baby moon shining with reflected light from the sun.

It will be one of the greatest scientific achievements in the history of mankind. And it will inspire awe, because that dot of light in the sky will mean that the world's mightiest rocket combinations have been fired for the peaceful purpose of learning more about the universe.

Ten such satellites between July, 1957 and December, 1958 will be launched. They are expected to cost about £3,000,000. This will be part of America's contribution to research that is being undertaken by 40 countries co-operatively, during the International Geophysical Year (I.G.Y.).

BOOSTING THE "BIRD". The attempt will be made to get the satellites into their orbits, at speeds close to 18,000 miles per hour. Three-stage rockets will be used to do this.

What will these satellites look like? What will go inside them? What will they do up there in space?

Since the first one has not yet been built, not even the experts can say exactly. Rockets, packed with electronic research instruments have been sent aloft repeatedly, as high as 242 miles, for a few minutes of space flight. They have successfully radio-telemetered their findings back to earth. Similar construction techniques and electronic instruments will go into the satellites.

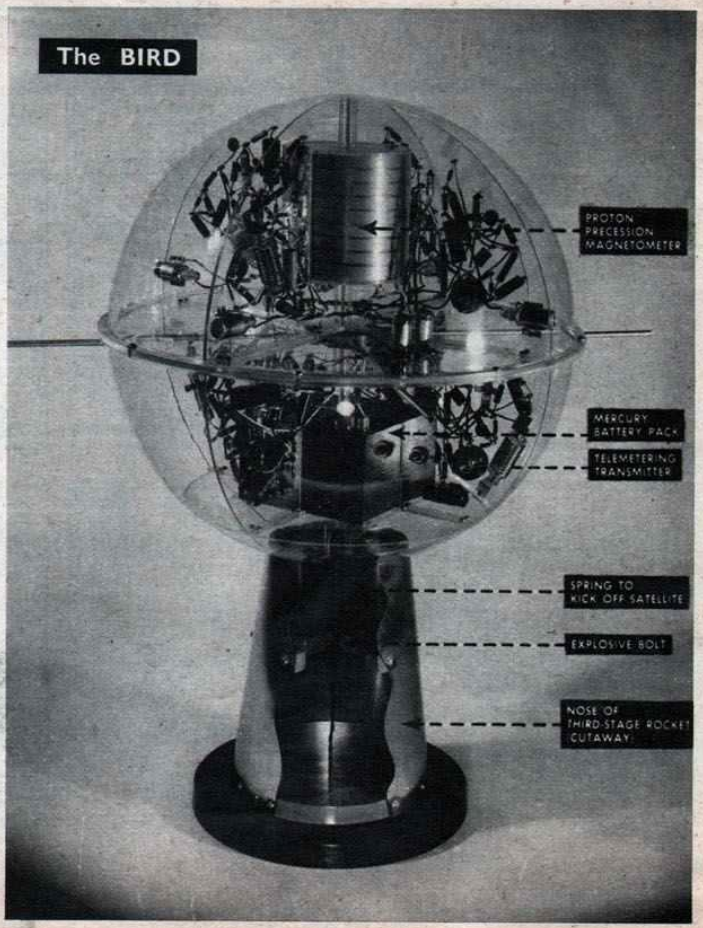
THE KNOWN FACTORS. A great deal of paper work has been done, of course, on the design of artificial satellites and there are certain known factors which are essential.

These known factors have been interpreted for *ROCKET* and *Popular Science Monthly* of America by members of the National Committee for the International Geophysical Year. These scientists are working intensively on the satellite programme. Thus, we can venture an educated guess as to the size, the shape, the weight and the contents of the first artificial baby moon.

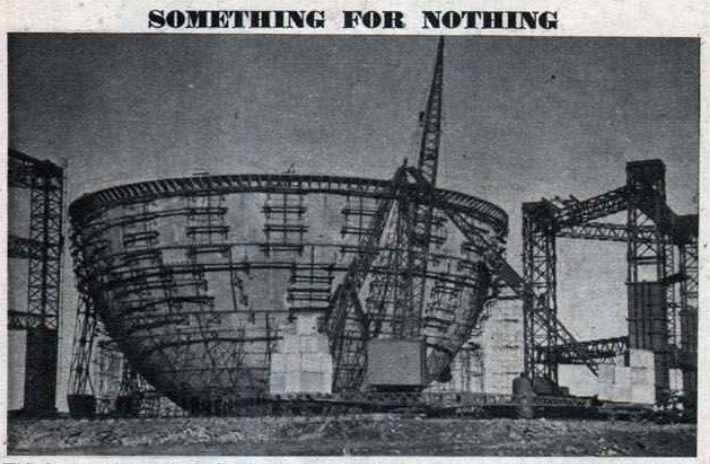
SIZE. This will depend to a great extent on the nose diameter of the third-stage rocket that will give the satellite its final boost into space and kick it off at the necessary orbital speed. A diameter of between 14 and 20 inches appears likely. If the satellite were too small, it would not be able to carry instrumentation, and might not even be "visible" for tracking by special optical and radio-finding devices.

If it proves desirable to use a sphere that is too large to go inside the nose of the top rocket, one solution has been suggested: It could sit, like an egg in an eggcup, on the truncated nose of the rocket, attached to it by an explosive bolt. At burnout time of the rocket, an electric charge would blow the bolt apart, releasing a spring to kick the satellite free like a jack-in-the-box. To give the sphere protection and an aero-dynamic shape for the ride up, it might be fitted with a sort of dunce's-cap cover.

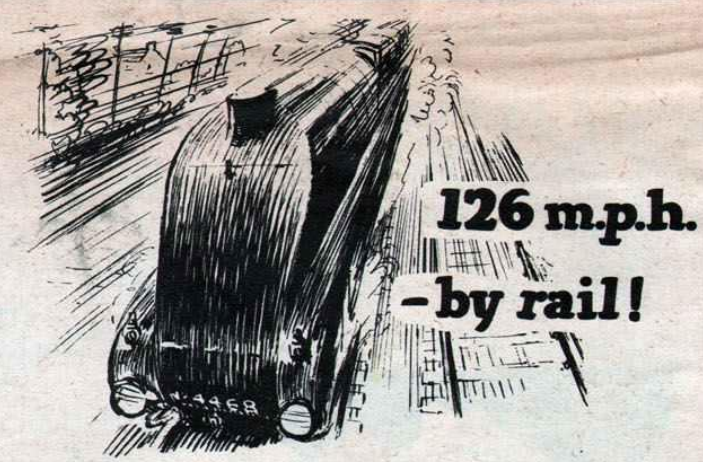
NEXT WEEK: More details of the Man Made Moon



SOMETHING FOR NOTHING



This is the sphere, 135 ft. in diameter, during construction at Dounreay (see Page 3). It will contain the core (about the size of a dustbin) of enriched uranium, which will generate heat estimated at 60,000 kilowatts. Its real importance will be to prove that in this type of reactor, the uranium consumed in producing the heat, creates further fuel (plutonium) which produces still further heat and keeps on increasing. Something for nothing, in fact.



Over Stoke Summit with a clear downhill road to Peterborough. It's a tense moment as Driver Duddington slowly opens the regulator of the great L.N.E.R. A4 class locomotive "Mallard". Faster and faster it goes until the special 7-coach train is streaking along the line at 126 miles per hour — more than two miles a minute. This famous run, on July 3rd 1938, established a new world speed record for steam locomotives that has lasted unbeaten for over seventeen years!

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Your Guide to Guided Missiles

by Commander J. YUNGE-BATEMAN, R.N.

We have a selection here of guided missiles under development in this country and the United States.

TRUE ROCKET

FIRSTLY there is the **"I.C.B.M." (Inter - Continental Bombardment Missile).** It is a true rocket and uses its motors to take it up and out of the Atmosphere and travels unresisted in outer space. Its range is 5,000 miles and it reaches a height of 500 miles. Once above the atmosphere it travels on its own momentum and reaches a speed of 16,000 miles per hour. It has to have a slowing device to prevent it burning up due to friction on re-entering the atmosphere. It carries a thermo-nuclear warhead and is controlled by self-contained inertial guidance or from the ground. This necessitates the use of a highly-developed electronic "brain."

NAVIGATES BY STARS

NEXT there is the **"Navaho."** This is an atmospheric missile that starts on rocket boosters until its ram-jet engine gets going. It flies at less than 50 miles up, has wings and navigates itself from stars by a special electronic brain. It is subject to rocket interceptor attack as its speed is much less than a ballistic missile. However, it can take evasive action and has an infra-red 'eye' to home it on to a city's warm atmosphere. It carries an atomic warhead.

FIRED FROM PLANES

THEN there are **Air-to-Air Rockets** fired from Intercepter planes such as the Ryan **"Firebird"** shown. These are directed and released electronically and will lock on to the target. Infra-red detectors or 'eyes' direct it to its victim, whatever evasive action is taken. Its target is the hot exhaust pipes of the enemy plane. It fires by proximity fuse, an electronic device set to explode the head as soon as the missile is close enough for the burst to do fatal damage.

QUEEN BEE STUNG

THE **"Falcon"** is an air-to-air controlled missile for use from planes attacking planes or other rockets in the air.

The Falcon, 6½ ft. long and 6 in. in diameter weighs 120 lbs. It fits snugly under the wings of the fighter who seeks out the target by radar. Once he has this within range and has measured its movements he throws over a switch and wakes up the Falcon.

The Falcon's brain starts to work. Its "head" contains as many electronic elements as four television sets inside the space of a 2 lb. coffee can.

The Falcon's delicate mechanism wakes up. Its tiny gyros spin and its feelers search out the enemy by finding the radar beams reflected from the target. The Falcon then takes off and at high supersonic speed pierces the target.

In one test, against a Queen Bee, the missile flew up the exhaust pipe—which was the end of the Queen Bee.

GROUND TO AIR

LASTLY, **Ground-to-Air** Defence Rockets such as the **"Nike."** Electronically controlled by special computers which are automatically fed with information from Radar stations at various points, this missile will lock on to its target as soon as it is close enough to take over from ground control. Can be fitted with infra-red or acoustic homing device.

Next week's ROCKET will give some exclusive news of the Army's new guided missile CORPORAL.

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NEWS OF OTHER WORLDS

MAN-MADE MOON

Further details of what the world's first satellite may look like

by HERBERT O. JOHANSEN

IN our last issue we gave you a general description of the "Bird," the satellite that will be launched next year and circle the Earth 16 times a day.

Here is further information, interpreted for *ROCKET* in conjunction with 'Popular Science of America' by members of the U.S. National Committee for the International Geophysical year. This is what it will be like.

SHAPE. A sphere is scientifically desirable. It always presents the same shape of surface in the direction of forward movement, no matter how it may spin or turn—an important factor to scientists who will be measuring the air-drag on the satellite to obtain accurate data about the density of the air at high altitudes. This information may affect the design of tomorrow's extremely high-flying aircraft, and of future manned space vehicles.

A sphere would also eliminate tumbling that might be characteristic of other shapes, such as a cylinder. A tendency to do that would interfere with radio-telemetering of data from the satellite to the ground. Again, however, the space available for a satellite in the third-stage rocket will undoubtedly influence the shape.

MATERIALS. The shell will have to be light, and therefore thin, but strengthened by internal bracing. Aluminium is generally favoured. One of the important studies proposed, however, is an investigation of unknown electric currents flowing in, and beyond the ionosphere. This could be done with a magnetometer, but the shell of the satellite used for this project should be both non-magnetic and non-conductive. That rules out aluminium and other alloys, and suggests that plastic will be used for at least one of the "Birds"—probably of a milky colour that would reflect and diffuse sunlight for greater visibility.

WEIGHT. This is something about which there will be no doubt once the rocket men know the power and performance of the rocket-launching system to be used.

The third stage, to reach an orbital altitude of, say, 300 miles, and an orbital speed of 18,000 miles an hour, will have a definite top weight limit. From this, subtract the weight of the third-stage rocket itself and its fuel and you have the maximum weight of your satellite. One extra pound of satellite would require 300 extra pounds of rocket fuel. Based on what can be done with existing rocket techniques, a good guess is that each satellite will weigh about 30 pounds.

INSIDE THE SATELLITE. Each bird will carry instruments for scientific research. Since there will be no attempt to recover the satellites or their instruments before they descend into the dense lower atmosphere where they will be destroyed, or will burn up like shooting stars, provision must be made for a radio-telemetering unit in each one to transmit information to ground stations.

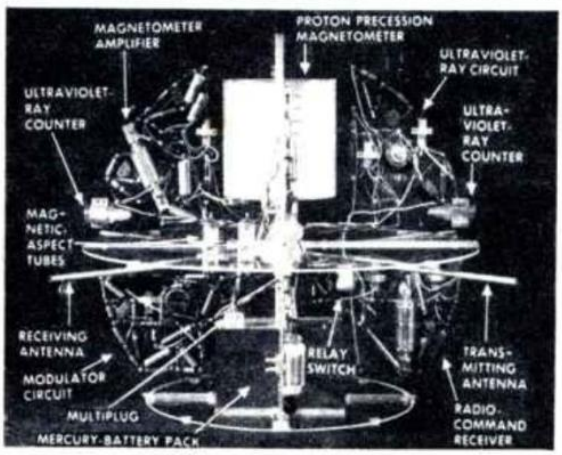
Such a transmitter, as well as the electronic research instruments, will require a power supply. Mercury batteries have been suggested because they give the best energy for weight and have an excellent shelf life (minimum loss of energy when not being used).

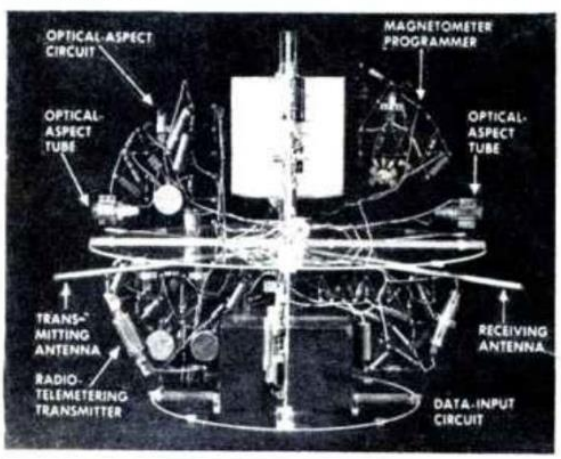
Solar batteries are not being considered at present. One reason is that they are still too new. They haven't the proved reliability and performance that the scientists want for all of the satellite's components.

GROUND SIGNALS. Any battery weight allowable for a satellite would not supply power enough for even one day of full-time operation of the various circuits. So to conserve power, the circuits will be turned on by radio signals from the ground for short periods only, when the satellite is in the best position in its orbit to obtain and transmit information. This calls for a radio-command receiver in the satellite. Consuming perhaps one-quarter of a watt, it will be on a constant alert to pick up a ground signal that will either energise the filaments and tubes or turn them off.

In a 30-pound satellite, it is estimated that current from a power pack of maximum weight, turned on for five minutes during each of the satellite's 16 daily passages around its 90-minute orbit could operate the instruments and transmitter over a period of 15 days. This is the probable length of time that a satellite orbiting at a 200-mile altitude would stay up.

NEXT WEEK:
More information on the 'Bird'.





MODEL SHOWS THE "BIRD'S" WORKS

These models were made by Herbert R. Pfister after consultation with scientists associated with the U.S. National Committee for the International Geophysical Year (I.G.Y.). Standard sub-miniature electronic parts were used to simulate the instrumentation which will be used in space to radio information back to earth.

Miracles in a "Pudding Basin."

This picture gives some idea of the size of the "Bird" and the components which go to make up the "First Man-Made Moon."

Dad's clean-bowled!

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THE FIRST SPACE-AGE WEEKLY

Week Ending 5th May, 1956. No. 3.

A 'News of the World' Publication.

4½d

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

THE UNKNOWN ENEMY PUTS UP A "FORCE-SCREEN"— AN ELECTRO-MAGNETIC CURTAIN—PROTECTING THEM FROM THE ROCKETS FIRED BY THE "HAWKINS"...

NEWS OF OTHER WORLDS

What we can learn from the man-made moon

by HERBERT O. JOHANSEN

Here is the final summing-up by Herbert O. Johansen on the artificial satellites to be launched next year.

In this, like the two previous articles we have described then, what the first artificial satellite may be like—the details of its construction, its close-up appearance, its probable functions. But its true significance will be the awesome achievement of science in projecting man's brain, into outer space.

A handful of mystery.

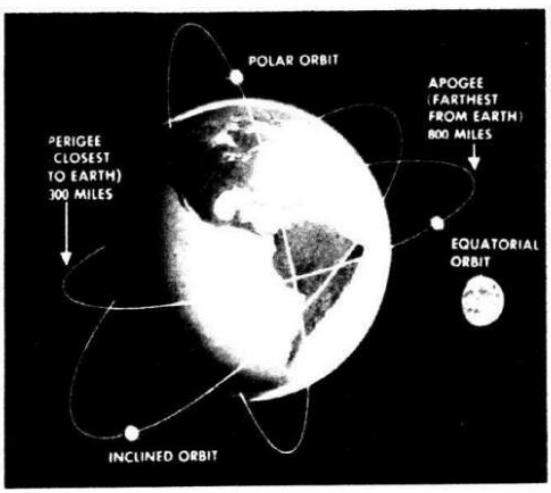
WILL YOU BE ABLE TO SEE A SATELLITE? Scientists say yes. Like our big moon, the little man-made one will have no light of its own, but will shine by reflecting the light from the sun. Under the right viewing conditions (shown in the drawing below) even a small satellite is expected to have the brightness of a fifth-magnitude star, the faintest star that is visible to the keen naked eye. To be seen, such an object must be illuminated by the sun's rays while the sky, or atmosphere, above the observer is black. It must be in the daylight while you are in the dark, that is, before sunrise or after dusk. Where, how often, and when you will be able to see the artificial satellite will depend upon the orbit into which it is launched.

A SATELLITE'S ASSIGNED SPACE-RESEARCH job and the desired path of visibility from the earth will determine the type of orbit into which any one "bird" may be launched. All of the orbits will be elliptical in shape. A satellite that is ejected at 300 miles above the earth, for instance, might swing out as far as 800 miles at the other end of its globe-girdling track.

Although the Satellite could not collect information and radio it back for more than 15 days (by which time it is 'worn-out') it would still be a useful object in space. Observers on the ground could track it with radio and optical devices to continue air-drag studies. And by observation from several ground stations simultaneously it could be used to give us more exact knowledge of the size and shape of the earth.

These studies that can be made by tracking from the ground, apply to all satellites. But aside from that, each bird will probably have a "personality" all its own. So many research jobs have been suggested that no one satellite could possibly carry the necessary instruments for all of them. These include studies of solar ultra-violet and X-rays, electrical currents and magnetic influences, cosmic rays, micrometeorites and hydrogen and ion densities.

Standard equipment for all the satellites probably will be a data-input circuit to code all information for intelligible transmission, and a modulator to superimpose the coded data on a carrier signal that will radio it to a ground receiving station, where it is interpreted. This is radio-telemetering.



NEXT WEEK'S *ROCKET* DEALS WITH BRITAIN'S ROCKET TO BE LAUNCHED IN THE COMING INTERNATIONAL GEOPHYSICAL YEAR.

* * *

HAVE YOU FILLED IN YOUR APPLICATION FORM FOR MEMBERSHIP OF THE *ROCKET* SPACE CLUB?
SPECIAL PRIVILEGE FOR FOUNDER READERS—SEE PAGE 4.

AND NOW DOWN TO EARTH

Aerial hedgehopping by troops may have been brought closer by the development of this light-weight, all frame "Egg-beater". The rotors are turned by a standard water cooled two stroke outboard engine. The "Egg-beater" can hover, fly in formation, turn sharply and scoot forward at speeds up to 70 m.p.h.

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Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

WITH the Rocket Launching Station built, the next thing is to build the Rockets to be used to construct the Satellite Station out in Space.

Here is a drawing of a Rocket built to establish a Satellite Station at a height of 1,000 miles above the Earth's surface. It is a three-stage job, height about 240 ft. and weighing 7,000 tons fully loaded.

Rocket motors, 50 of them, take it up in the first stage on an Eastward curve to a height of 25 miles, burning 5,000 tons of fuel to do so. The second stage with seven motors takes the rocket up, after the first stage drops off, to a height of 40 miles and then it too drops off.

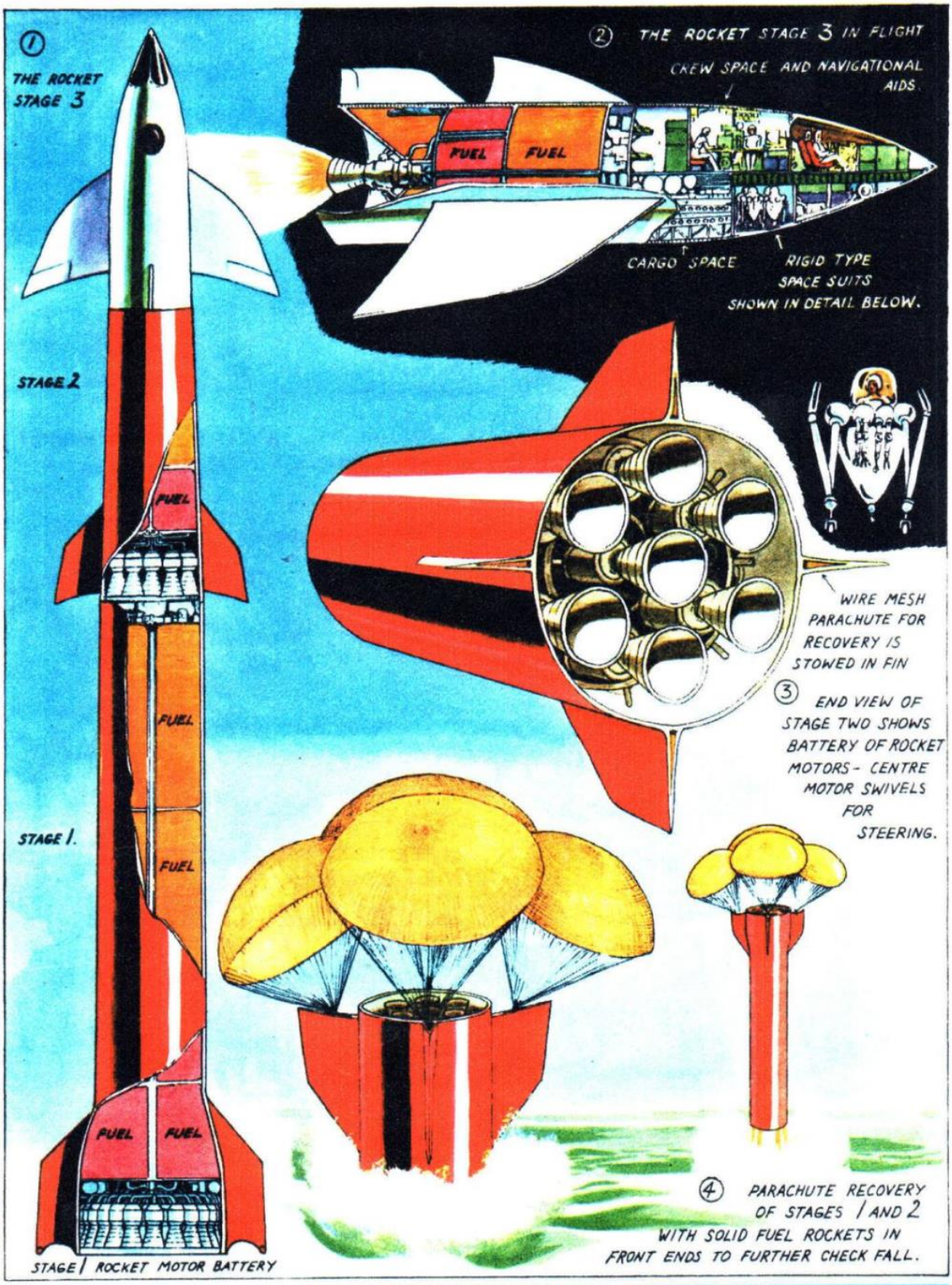
The third stage then goes on to reach the desired height of 1,000 miles, using sufficient fuel to place it on an orbit that will get to this height. It does not expend all its fuel to do this. Both stages one and two are automatic and remote-controlled. The crew come into action in stage three.

THE Third Stage is seen in section. The crew take over after the second stage falls off. Before this they can do nothing as the terrific acceleration renders them powerless on special prone position couches. This stage has wings, necessary for the return journey. The big rocket motor is swivelled to control the course. Radar communication is kept with 'Control' on the 'Station,' checking course, position and speed. Space has to be given to carrying pre-fab space station parts, as shown. Space suits for dumping cargo have to be carried. These are more like the deep-sea divers' gear than the streamlined suit of fiction. They are fully mechanised and carry batteries, air and gas, for jet manoeuvring.

THE rocket batteries are fitted as shown in the drawing of the second stage. One or more motors are swivelled to change course. These stages with their complicated machinery and electronic control equipment are too valuable to lose. Planned to fall in the sea hundreds of miles from the Rocket Station their Recovery Parachutes housed in the fins slow them down before they hit the water. Solid fuel rockets in their noses also check them just before impact. Radio beacons are carried and enable the recovery ships to locate them.

PARACHUTES are made of wire mesh and will be automatically released at the desired time after the stage has left the rocket. This recovery is an important point. Many trips are needed to build a space station and a large loss of these stages would make the project unduly expensive.

The scale of the drawing of the complete rocket is 1 to 240.



Each week Commander J. YUNGE-BATEMAN'S articles with illustrations in full colour will appear. They should be mounted and displayed on Information Boards in Schools and Clubs.

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 12th May, 1956. No. 4.

A 'News of the World' Publication.

ROCKET

Edited by DOUGLAS BADER

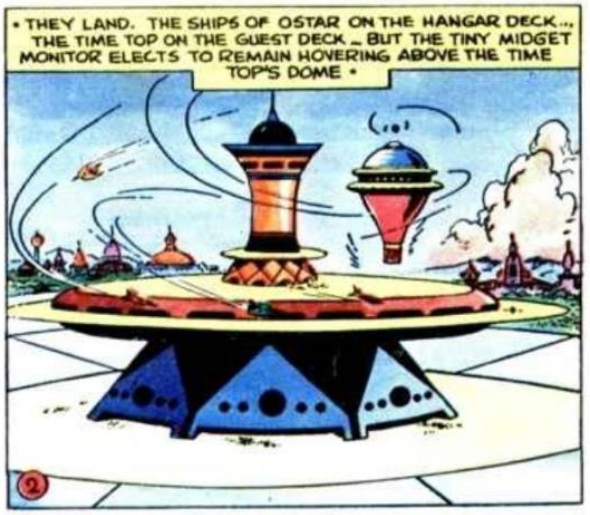
CAPTAIN FALCON in MOON-BASE PATROL

THE SPACE PATROL CRUISER, "HAWKINS", ENTERS INTO COMBAT WITH THE UNKNOWN ENEMY.

DISASTER FACES THE CREW OF THE "HAWKINS" WHEN FALCON IS INJURED...

BRICK BRADFORD

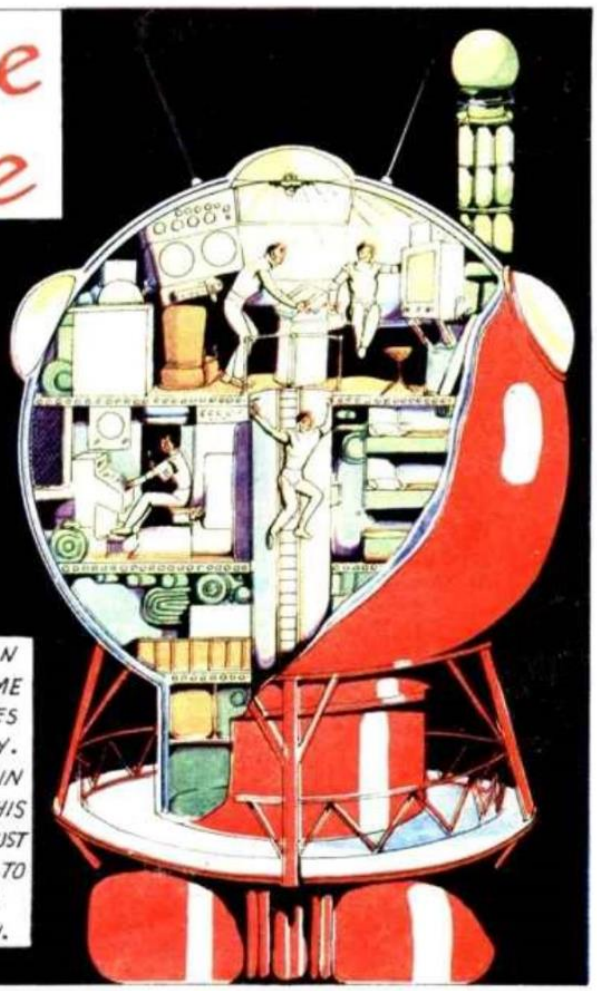
BY CLARENCE GRAY



Strange AND True

THE WATER SPIDER HAS SOLVED THE PROBLEM OF LIVING IN AN ALIEN WORLD. UNABLE TO BREATHE UNDER WATER IT SPINS A BALLOON OF SILK, FILLS IT WITH AIR AS SHOWN & LIVES WHERE NO OTHER SPIDER CAN.

AND NOW SPACE-MAN IS FACED WITH THE SAME PROBLEM. HE TOO SOLVES IT & IN A SIMILAR WAY. HIS BUBBLE OF AIR IS IN THE CREW SPHERE OF HIS SPACESHIP, WHICH HE MUST KEEP RENEWED IF HE IS TO SURVIVE IN THE ALIEN ENVIRONMENT HE IS IN.



Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N

THE MOON SHIP

THIS vessel is going to be something very different from the satellite rocket which is to be the first stage of travel into space. It is for use in space only and being designed for these conditions it will be useless for work in any atmospheres. So it will have to be built out in space.

As there is no air resistance to contend with, streamlining is quite pointless and the only thing that controls the shape of the ship is the function of the various parts. As it will have no gravity force to contend with in space and only one-sixth of the earth's gravity on the moon it can be much more lightly built than the satellite rockets.

THE ship itself consists of a spherical crew space attached to a central framework which carries all the essential mechanism for control and navigation, the permanent fuel tanks and at the rear end the rocket motor battery. Outside and around this central core are the departure tanks which are dropped off when exhausted. The illustration shows these points clearly. Steering and pointing the ship is done by special swivelled rocket motors. The crew space must be pressurised, carry air-conditioning and reoxygenation apparatus, and be insulated against heat, cosmic ray and meteoric bombardment.

Telescopic tripod landing legs with hydraulic shock absorbers are used for touching down on the moon once the journey has been completed. This is done by slewing the ship by rocket blasts until it is descending tail on. As the surface is approached the ship is checked by rocket blast. The hydraulic shock absorbers take care of the final bump, if any; and also adjust themselves to uneven surfaces.

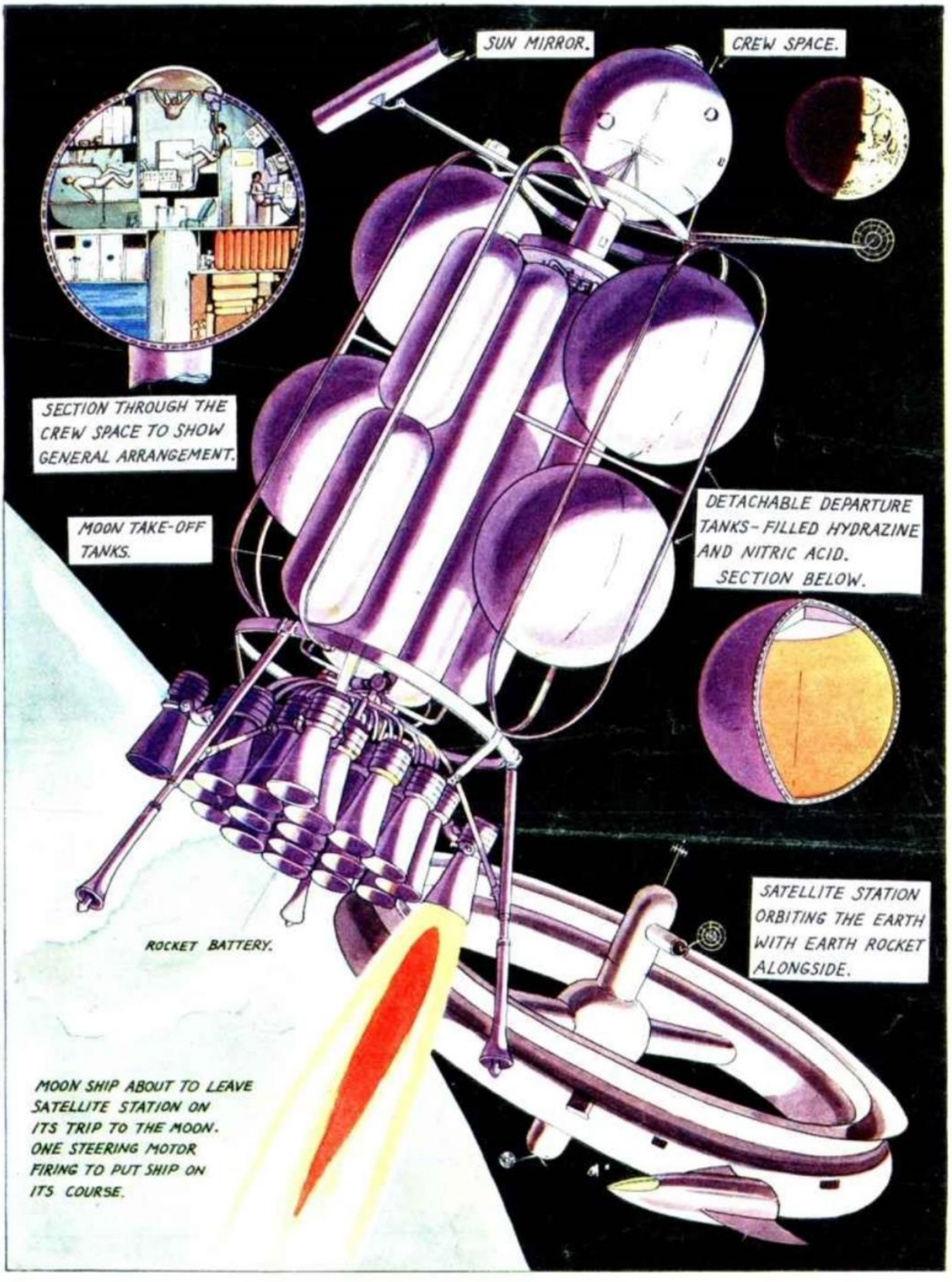
THIS type of ship cannot be used to land on objectives that have an atmosphere to cause resistance to a body falling, but can go anywhere else; and of course any distance into space, as once its speed is built up it continues at that speed until checked either by its own rockets in reverse or by the attraction of a heavenly body. To land on a planet with atmosphere, a satellite must be chosen or a satellite station built, at which the crew and cargo can be transferred to a rocket ferry similar in design to the third stage of the multi-stage rocket used to leave the earth and reach the satellite station.

A SOLAR mirror will be used to work a generator to supply electrical power and recharge batteries. Power is needed to work all forms of Radar Navigational apparatus, the air-conditioning plant, lighting, cooking, etc.

This ship carries enough fuel for moon departure take-off and coming to rest at the earth space station as well as for the outward journey.

However it may be that the journey will have to be made by two or three ships in company, one of them being mainly a fuel carrier, would be left behind on the moon and its tanks used to give a greater margin of safety to the other two. It could be crewless and controlled from the leader.

Next Week:
Assembling the Moon Ship.



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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 19th May, 1956. No. 5

A 'News of the World' Publication.

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

RENA, THE SPACE NURSE ON THE "HAWKINS", HELPS TO REVIVE THE INJURED FALCON.

BUT THEY ARE FACED WITH A CRASH LANDING ON MOON-BASE...

Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

ASSEMBLING THE MOON SHIP

AS it is designed for pure Space Travel and so cannot be used in atmospheres the Moon ship has to be built out in space. It will be 'pre-fabricated' on Earth and the parts packed into Satellite Rockets which will take them up to the Satellite Station which is orbiting the Earth 1,000 miles above us. Incidentally this Satellite Station has been built up in space in just the same way. Arrived at their destination the Rockets take up their orbit and the crew proceed to dump the cargo of parts that they have brought. These of course have to be pushed out as we are now at zero gravity conditions. Once out they will stay in the dump. A steady stream of Satellite Rockets is required to build up enough stores to make the three Moon ships that will be required for the trip. All the parts of each ship will have to be marked in a distinctive way for easy assembly.

Erecting the Vessels

NOW the assembly crews from the Satellite Station take over the job of erecting the vessels. These men will have to have been fully trained in their very unusual job of floating about alone in space and conditioned to working in a no gravity area. By no means a simple thing to achieve. Each man is in a space suit, actually a pressurised capsule with a transparent hood, various automatic arms and tool holders, jet propulsion, lighting, and automatic temperature control. In these little space eggs each man is quite mobile and comfortable and can carry out the necessary constructional jobs that arise.

Assembling the Framework

FIRST the main framework is assembled and the crew space sphere is attached. Work goes on inside this sphere as soon as it is pressurised. Then the small or Moon take off tanks are fitted, followed by the Rocket battery and all the numerous pumps and equipment connected with fuel supply, etc. Then the big spherical departure tanks with their special dropping gear are attached and the telescopic shock-absorbing landing legs. These are shown at the bottom of the illustration. They are fitted with flame guards as they will extend through the blast area of the rocket motors. Once everything has been fitted up fuelling and testing must take place. A fleet of tanker rockets have been dispatched from earth and are in company with the Satellite Station awaiting the time for their use.

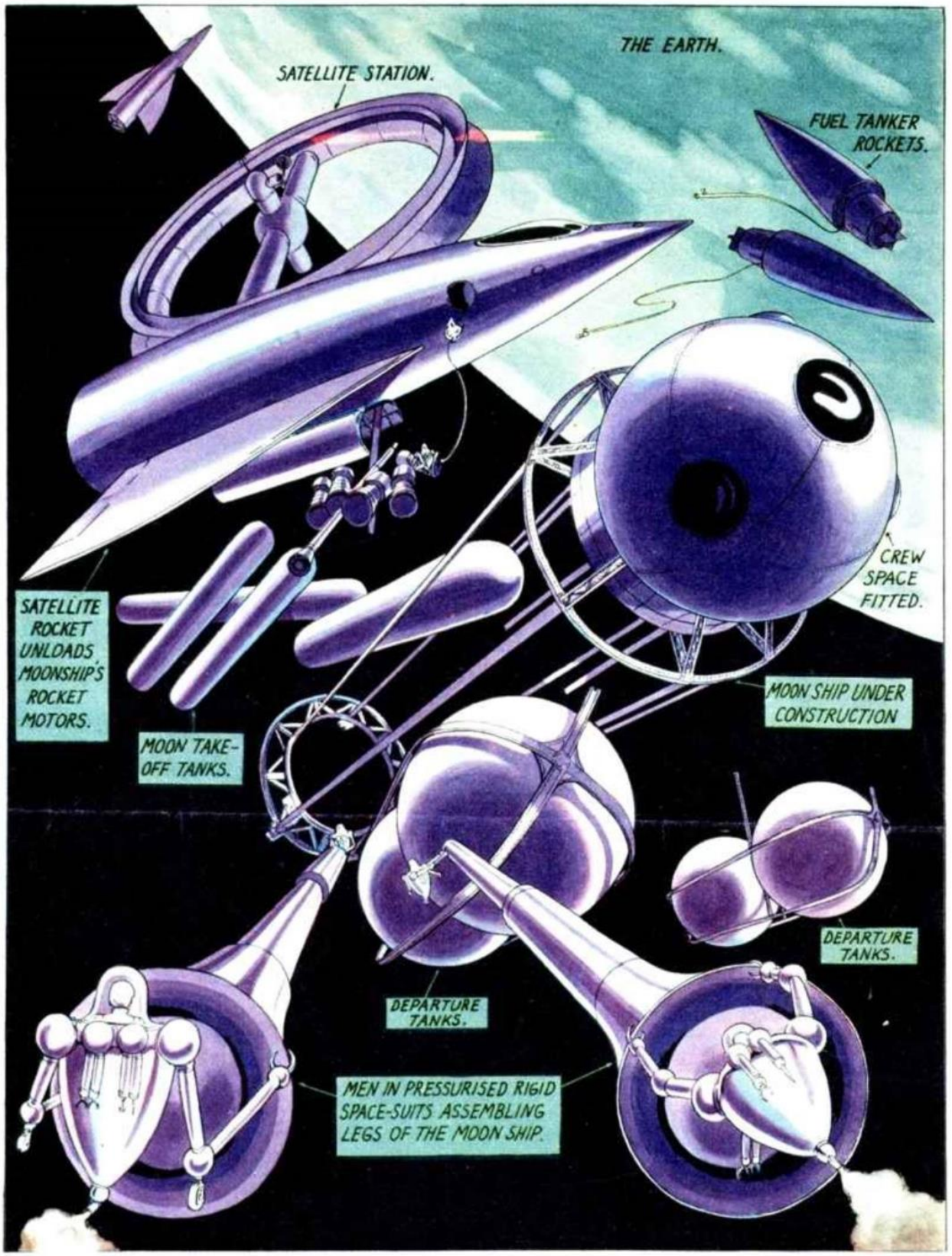
Once the Engines and Equipment have been tested and passed, the ship is fuelled with its vast quantity of Hydrazine (the fuel) and nitric Acid (which supplies the Oxygen for combustion).

Now the crew who have recently made the trip from Earth by rocket and are standing by in the Satellite Station get their final briefing and come on board. Their job is to be to take the ship to the Moon and establish the first element of a lunar base. The initial orbiting surveys without landing having been made previously and the Moon landing area chosen and mapped out. They are then to return to the Satellite Station. Further trips to enlarge and improve the base will then be organised.

Tanker Rockets that are orbiting with us and are now empty will be refilled by shuttle rocket service in readiness to fuel other spaceships as they reach completion.

Before taking off for the Moon let us take a look at the Satellite Station from which the crew have just arrived.

Next week:
THE SATELLITE STATION.



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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 26th May, 1956. No. 6.

A 'News of the World' Publication.

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

THE "HAWKINS", DAMAGED IN THE SPACE BATTLE WITH AN UNKNOWN ENEMY, LIMPS BACK TO FIND ANOTHER ADVENTURE ON MOON-BASE...

The Frontiers of Space

by Commander J. YUNGE-BATEMAN, R.N.

☆ ☆

SATELLITE SPACE STATION

THE Satellite Space Station is a wheel-like structure 250 feet in diameter. It consists of 20 sections of flexible nylon and plastic material each being an independent unit as shown at the bottom of the page, joined together and held rigid by internal air pressure of about 15 lbs. per square inch. It has to be white or silver coloured due to heat absorbtion being excessive with any darker tone. Special non-absorbent coloured finishes will however be developed.

Heat, Light and Power

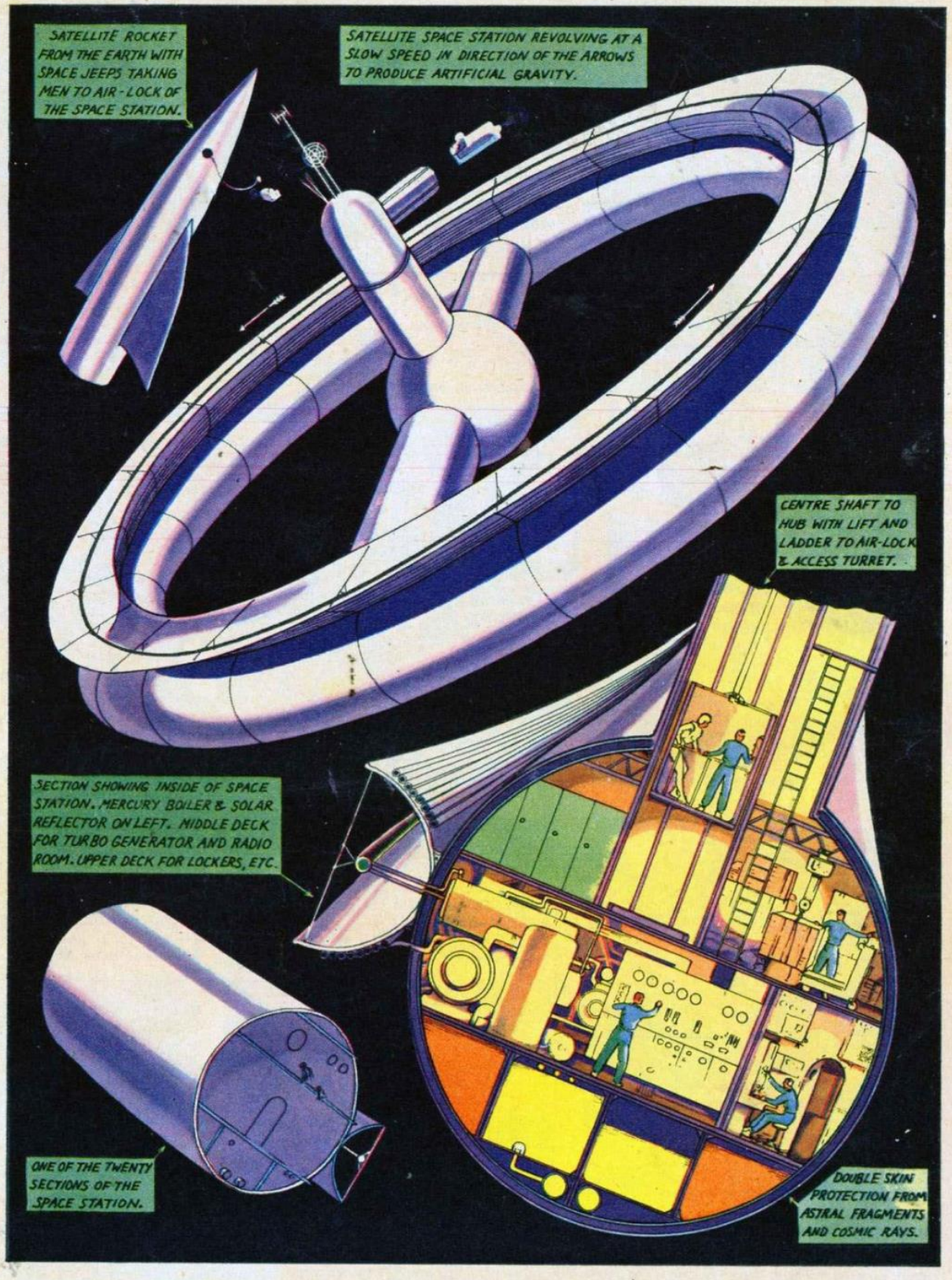
Heat, light, and power for the station come from the sun. A circular reflector of polished metal runs round the outside of the living quarters and focuses the heat on to a pipe-like mercury boiler. The high pressure vapour from this drives a turbo generator in the engine space. Cooling pipes for condensing the mercury vapour run round the shadow side of the reflector. There is now a possibility of a more direct transference of the sun's heat into electrical energy. This will eliminate the need for the mercury boiler and turbo generator. It would be based on the principle of the bell solar battery that uses extremely pure silicon crystal plates.

Why a wheel?

The wheel shape is to enable an effect of gravity to be produced by spinning the whole around its axis at a calculated speed. The men will then be able to move normally.

The initial movement would be given by jets and as soon as the correct speed is attained the motion will be continuous, as there is no resistance to slow it down in space. Centrifugal force makes a substitute for gravity.

The boarding turret in the hub can be rotated independently so as to enable access to be made without interfering with the movement of the space station. This will also be used for observation of heavenly bodies, for checking on possible drift from the correct position, and the visual checking of store dumps left in space. At the hub, however, the state of weightlessness will again be experienced as the pull of the centrifugal force will be negligible. This will make a very convenient 'clinic' for conditioning space men to accustom them to the very peculiar psychological reactions that may be experienced in a state of zero gravity. A most important point in maintaining crew efficiency.



Fuel and Stores

The whole will carry fuel and stores for a long period, which will be kept replenished by shuttle rocket service from the earth. The crew will have its living quarters in one part of the perimeter and there will have to be additional accommodation for space ship crews and fitters, when a mission is in course of preparation and the task force is being assembled. From this station all the work of storing and building the big space ships is organised and carried out with materials and personnel sent up from earth by shuttle service rocket.

A height of 1,000 miles would be chosen for its orbit, this being about the limit of lift for the satellite rockets that have to be used to get off the earth; to clear the resistance of the atmosphere, and obtain a reasonable orbiting speed. The life of such a station should be sufficient for the first space pioneering trips by which time improvements in design will call for a new model.

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 2rd June, 1956. No. 7.

A 'News of the World' Publication.

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

A MYSTERIOUS INTRUDER WHO HAS LANDED NEAR MOON-BASE IS CAPTURED BY FALCON AND HIS CREW IN THEIR MOON-SKIMMER

OTHER THRILLS:—

FLASH GORDON P.8
JOURNEY TO THE MOON P.15
SEABED CITADEL P.16

Across the Frontiers of Space

by Commander J. YUNGE-BATEMAN, R.N.

JOURNEY TO THE MOON

THE survey is to be made in the space ships erected and provisioned at the space satellite station. Three will be required for the Operation of which one, the freighter, will be unmanned and controlled from one of the others. The purpose of the journey will be to establish a base on the moon. This will be used for space research, training of space crews and as a nucleus for a permanently established base for the building and operation of space ships and freighters needed for interplanetary travel and exploration. To make the journey the ships will fire their rocket motors and accelerate until they reach escape velocity to leave the earth's attraction. This will take all the fuel in their big spherical take-off tanks and these they will jettison as soon as they are empty. The motors will be firing for 34 minutes during this manœuvre. The ships will now coast on their pre-determined course with motors shut off until they come to the point where the moon's gravitational pull is more than the earth's which they are leaving. They will then start to fall towards the moon.

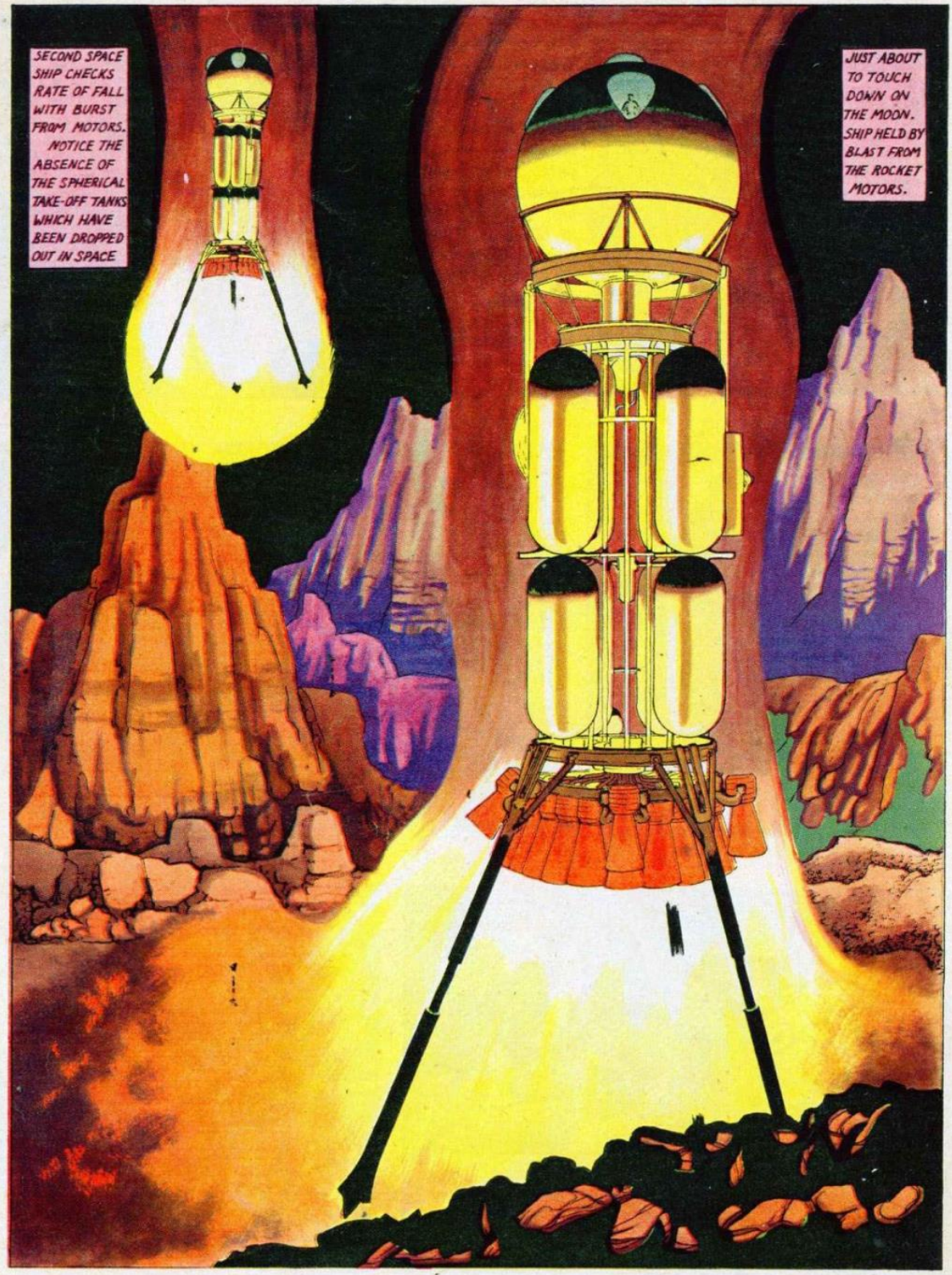
Landing on the Moon

SHIPS must now be turned to fall tail first and as they approach the moon's surface motors must be fired to check speed. Finally as touch down takes place full blast may be required to secure a safe landing.

If conditions arise to make it necessary, the ships may be checked and put in orbit to circle the moon at a pre-determined height. Freight could then be transferred as necessary, fuel tanks shifted to another ship, should there be a shortage due to any reason. One ship could then be used as a landing ship with the certainty of a full supply of fuel for subsequent take-off.

Moon Base

HOWEVER, the aim is to get the men on to the moon's surface and to land sufficient stores to set up a small but efficient base that can be expanded by future trips. To do this at least one of the ships will be left on the moon, the fuel transferred to the return ship and the material of the abandoned ship used to build up the base. The expedition will be in wireless communication both sound and visual with the earth and the satellite station throughout the whole trip. The time on the journey, from Earth Satellite station to Moon would be 4½ days.



Limited supplies

SUCH a journey is not a long one and the crew should not find the experience physically exhausting. It should be possible, using the three ship task force to carry sufficient provisions for the stay that will be required, while establishing the advance lunar base. But the supply of food, air and water is strictly limited and a further series of ships will have to be sent to carry sufficient provisions for the time required to establish the advance lunar base, and also to start building up a stock-pile. The crews will also need relief at frequent intervals and will have to be returned to earth for rest and recuperative measures.

Contact with Space Fleet

EACH trip that is made will make the next one easier. The advanced base and the space fleet being in radio contact with base all the time, help will be available to counter any crises that may arise.

With the advanced lunar base established the next step is to make it self supporting. **Next week we shall see the attempt being made.**

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 9th June, 1956. No. 8.

A 'News of the World' Publication.

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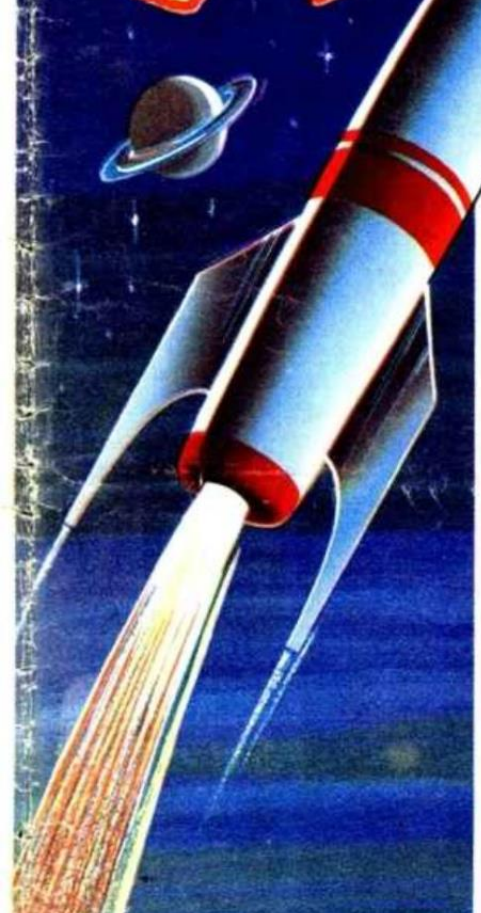
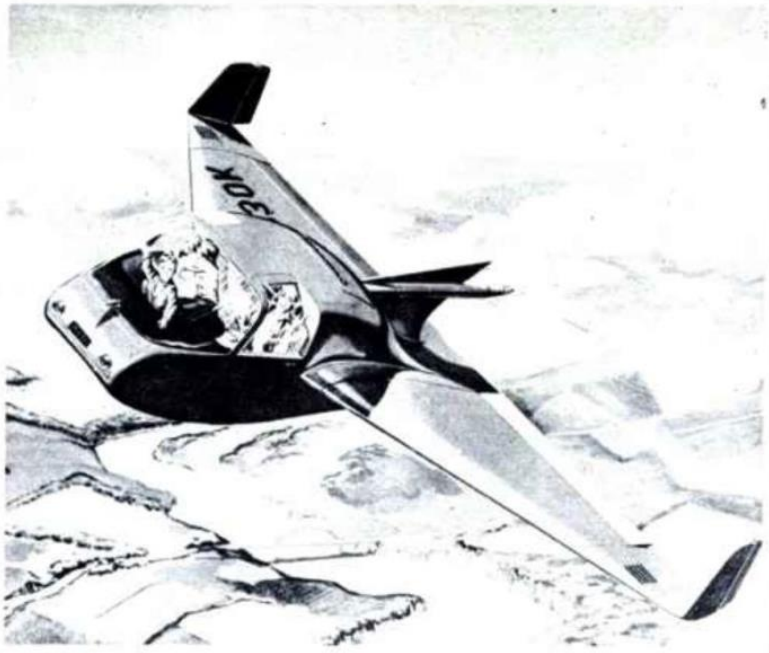
Edited by DOUGLAS BADER



CAPTAIN FALCON in MOON-BASE PATROL

FALCON DISCOVERS THAT THEIR CAPTIVE, FROM THE MOON-SKIMMER, IS A YOUNG ADARAN GIRL— LURI....

AIR—SEA—LAND—SEDAN



AT last it is here—or if not exactly here, it is in sight, 'Skeets' Coleman, the U.S. Navy test pilot of the vertical take-off fighter 'Pogo' has designed this air-sea-land — ? ? ?

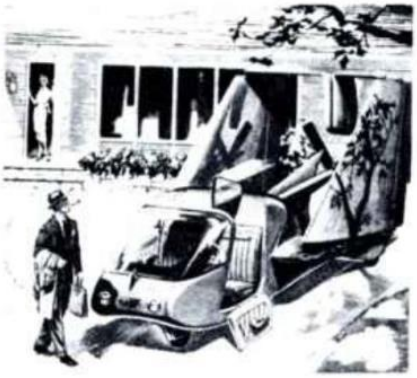
Can you give it a name?

Send in your suggestions to the editor. One guinea for the best.

The prototype is now being built in California. The engine is 215 horsepower and will push the 2,500 pound plane at about 200 miles an hour in flight. The delta wing shape offers exceptional stability in the air.

But on land the pilot will have to be satisfied with a modest 50 mile limit. Once down the wings fold and the car is ready. It is a three-wheel job, the front wheel doing the steering. The other two wheels of the landing gear are power driven.

For water landings and take-offs (seen in the photograph on the right). There will be hydro-ski's mounted under the plane's watertight hull. Both ski and wheels retract in flight.



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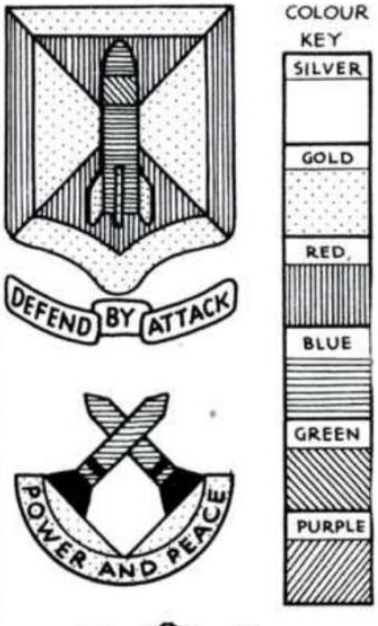

SEE EDITORIAL PAGE 4.

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★ *This official*

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BRICK BRADFORD

BY CLARENCE GRAY

• CAPTAIN PERO BRINGS THE GRAVICOPTER DOWN ON A FARM ESTATE BORDERING THE CITY OF OSTRONIA •

WHY DO WE LAND HERE, CAPTAIN PERO!

HERE, PRINCESS FAIRLA, WE SHALL INTERVIEW THE ONLY ONE ON ALL OSTAR WITH THE LUCK TO HAVE ESCAPED ENSLAVEMENT AFTER CAPTURE BY A MENTAL SATELL-CELL... AN HONORABLE GROWER, LOKKA!

1

• AFTER MAKING WELCOME THE PRINCESS FAIRLA AND HER PARTY, LOKKA RELATES HIS EXPERIENCE •

MY DEAR PRINCESS, I LIVE YET IN FEAR! IT WAS DURING THE LAST RAID... I WAS WORKING THE FIELD WHEN ONE OF THE DREAD SATELL-CELLS DESCENDED UPON ME!

2

3 • THE TINY TERROR WHIRLED ABOUT MY HEAD SCREECHING IN AN UNBEARABLE PITCH OF SOUND --

4 I STRUGGLED VAINLY TO BAT IT AWAY --

5 I RAN - IT FOLLOWED ME --

6 I COVERED MY HEAD WITH MY CAPE - BUT TO NO AVAIL. - THE TERRIBLE SCREECHING CONTINUED.!"

7 • I BECAME DIZZY! EXHAUSTED, I DROPPED TO THE GROUND!

8 SUDDENLY THERE WAS QUIET! THE CELL STOPPED SPINNING! A VOICE CAME FROM IT. IT SAID -

9 - IT WOULD LEAD ME TO THE NEW LIFE ON OSTAR!

10 I REBELLED - I SHOUTED REFUSAL!"

11 • AGAIN THE CELL ATTACKED ME - WITH AN EVEN GREATER INTENSITY OF SOUND!

12 I LOST CONSCIOUSNESS!

13 WHEN I AWAKENED I WAS A SLAVE! I FELT ONLY A DESIRE TO FOLLOW THE CELL'S DICTATES.

14 IT WAS AT EXODUS PASS THAT SOMETHING HAPPENED TO SAVE ME!"

12-19

CONTINUED

Strange AND True

IN A WELL ARRANGED GOLD FISH BOWL THE PLANTS ABSORB THE CARBON DIOXIDE THAT THE FISH BREATHE OUT, AND RETURN OXYGEN TO THE WATER; EACH TAKES UP THE OTHERS WASTE GASES AND SUPPLIES ITS VITAL NEED. THE FISH CAN EAT WEED.

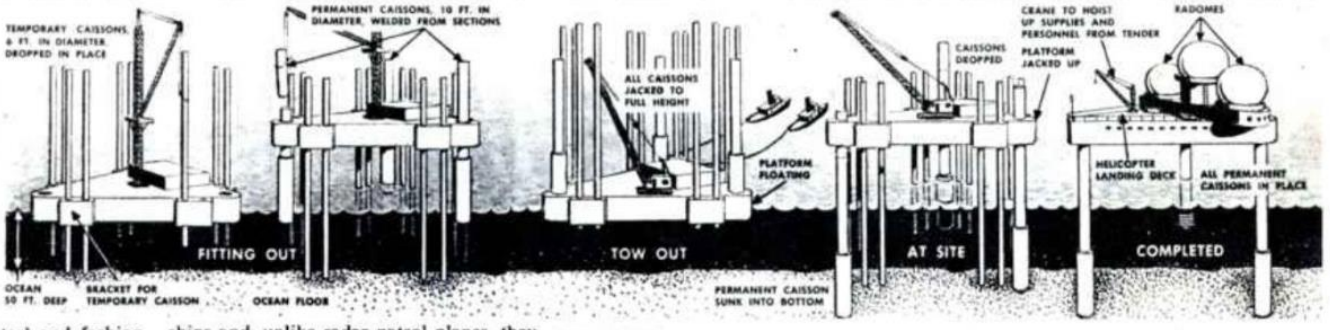
↑ A POND WEED OR ALGAE MUCH MAGNIFIED.

THIS METHOD OF AIR CONDITIONING MIGHT BE USED FOR LONG SPACE JOURNEYS; STALE AIR BEING PUMPED THROUGH ALGAE BEDS TO ABSORB CARBON DIOXIDE AND RENEW THE OXYGEN. THE ALGAE GROWTH, PICKED AND PROCESSED TO MAKE IT TASTE NICE, COULD FORM AN IMPORTANT FOOD SUPPLY, AND SAVE MUCH STORES SPACE.

MAN-MADE ISLANDS KEEP RADAR WATCH

Island floats out – climbs up on stilts

Platform was built ashore like a ship, with 15 tube-like caissons towering 195 feet in air along sides. At site, caissons were dropped to sea bottom and platform, riding them, jacked up. Finally, 12 caissons were removed, leaving three, concrete-filled, as permanent supports.



TAKE 6,000 tons of steel and fashion it into a triangle 200 feet on a side. Move this clumsy pie slice 110 miles into the open Atlantic. Hoist it up in the air so its bottom is 67 feet above the sea. Prop it there on three huge steel toothpicks stuck into the ocean floor. Do the whole job in the few scant weeks between the last spring gale and the first storm. And do it in waters too rough for normal floating construction equipment to operate.

Plugging the Gap. That is the challenge faced by the engineers who have to fix radar stations at sea.

The Tower rises altogether 83 feet in the air and 133 above the ocean floor. It is the first of a chain of radar stations to be built along the continental shelf off the east coast of the United States. For delicate electronic detection devices they will provide a steadier base than tossing picket ships and, unlike radar patrol planes, they will function in all weather.

The tower must offer minimum resistance to waves, yet be strong enough to stand up against the heaviest storm. The working platform must be high above the greatest hurricane wave, yet the base must be firmly rooted in the bottom. The unit must be compact, yet completely self-contained so its garrison can ride out gales that will cut them off from shore for a month.

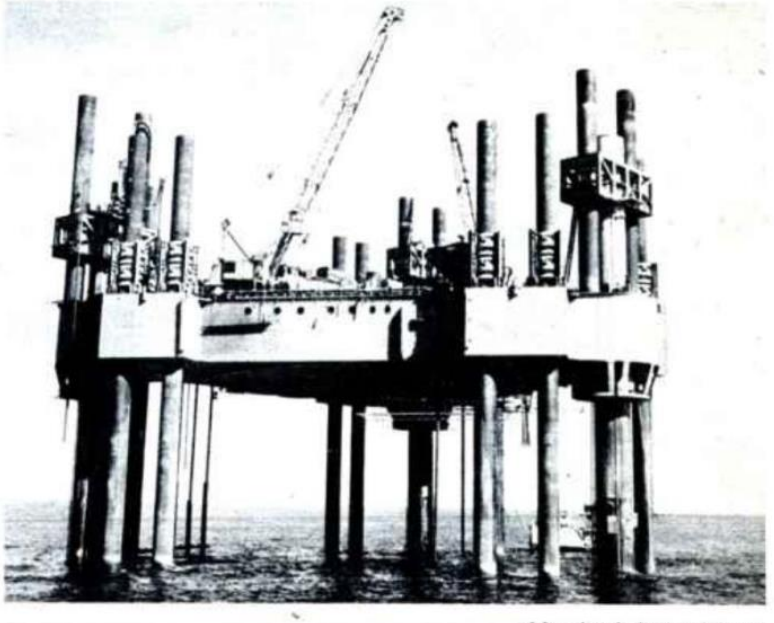
Drillers showed how. Navy engineers, who planned the island for the Air Force, solved the design problem with a triangular platform mounted on three legs. The installation problem was solved by drawing on experience gained in building platforms for underwater oil-drilling.

The platform was built watertight, like a ship. It was towed to sea and its 15 supporting caissons were driven into the ocean bottom. Pneumatic jacks raised it above water.

Manning a frontier. The island is scheduled to be completed next month and turned over to the Air Force. Following installation of the radar equipment, a force of 60 to 100 specialists will take over. As isolated as any frontier garrison, they will live on half an acre of steel deck, 110 miles from land. Only fogs, hurricanes and winter and spring gales will vary the sea's monotony.

Crews will arrive in 'baskets' by rubber rings with railings, lifted in by crane. The sea prevents mooring alongside the islands. (See photograph on the left.)

But if an enemy raid should come, these islands may provide the warning that can avert catastrophe and, of course, they will serve useful sources of information for experimental flying and guided missiles.



Our Solar System: The Asteroids

BETWEEN the orbits of Mars and Jupiter there is a ring of tiny planetoids—rocks of a few miles to several hundred miles in diameter, thought to have been caused either by an unformed planet when the Solar System was born or by the breaking up of a newly formed planet by the gravity of nearby giant Jupiter.

The four largest are bigger than the Martian moons—Ceres, 485 miles in diameter, Pallas, 304 miles, Vesta, 243 miles and Juno, 200 miles—and together roughly cover an area the size of the British Isles. Since their discovery at the beginning of the 19th century, some 1,500 planetoids have been detached but there must be thousands more too small to be observed by our telescopes.

Many of the meteorites which strike our atmosphere come from this patch of 'cosmic debris' in the sky.

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Across the Frontiers of Space

by Commander J. YUNGE-BATEMAN, R.N.

ESTABLISHING A LUNAR BASE

THERE is no doubt that a Lunar Base will have to be built up if space flight is to be developed. Furthermore any complete and useful survey of the moon for raw material, Uranium and other valuable natural products will take time. Some sort of community will have to inhabit the moon and lead a reasonable life there.

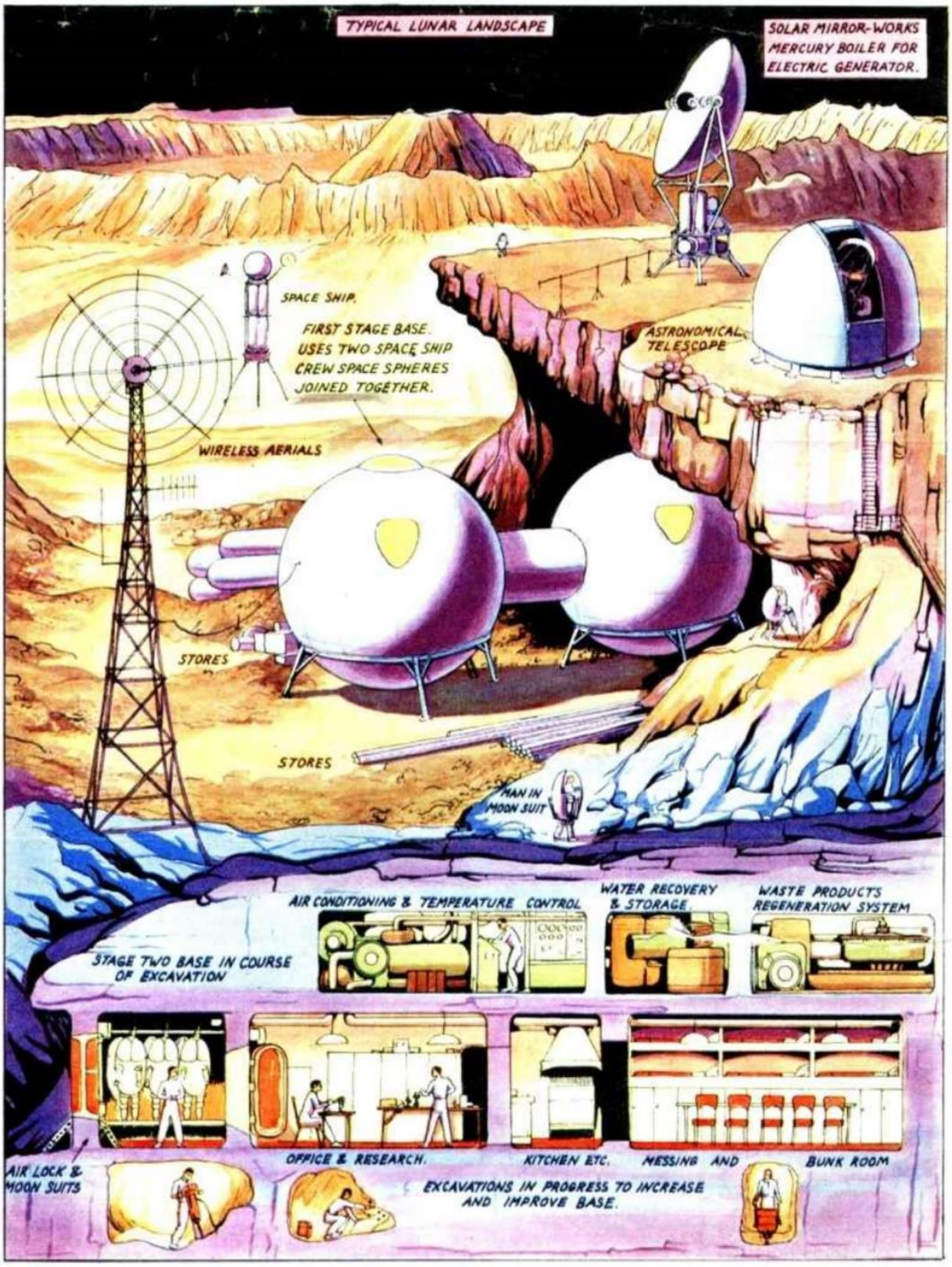
The first and temporary base will have to be hooked up out of materials and parts taken to the moon by space ship. The living quarters and immediate necessities can be constructed from the crew space of one of the space ships. In the picture two such spheres are shown joined together and placed as far under shelter of overhanging rock as possible, to guard against damage or destruction by meteoric particles which are believed to be continually bombarding the moon's surface.

MOON'S ATMOSPHERE

SOME experts query the belief that the moon is absolutely without atmosphere. However, this can only be discovered by exploration. As soon as possible further essentials to space survey will be ferried up from earth. The wireless installation, the astronomical telescope, television cameras, etc., will all have top priority. Stores, food, water and AIR will all have to be supplied somehow. The air contained in the crew spheres will have some form of chemical closed circuit purification system, to dispose of the carbon dioxide and renew the oxygen. For a lengthy stay, however, oxygen will have to be produced on the moon. One of the first factories will have the production of an artificial atmosphere as its object. This belongs to the second stage of the Lunar base. As work proceeds more space will be required and spaceman will have to tunnel underground in soft rock to form his Lunar home. Later it will be possible to build as well, should it be found that the fear of meteoric bombardment is overdone.

START OF THE ADVENTURE

IN the picture, at the bottom is shown the start of this gigantic venture. As each bunker is dug so it must be supplied with air at a suitable pressure. Notice the air lock to stop any air from escaping when entering or leaving the place.



Air must be pumped out of the air lock before the outer door is opened, as no air must be lost. Notice also the moon suits. Jet propelled space suits won't work on the moon as we have considerable force of gravity to contend with (one sixth that of the earth). So the moon suit will be a shell to contain the spaceman and protect him from heat, cosmic rays, etc. and give him an adequate air supply at the right pressure. Due to the reduction in the force of gravity he will find it quite easy to walk around in this odd looking suit. It gives him a strange Humpty Dumpty appearance similar to a deep sea diver's equipment from which it has been taken.

As time goes on Lunar Base will develop into somewhere quite comfortable to live, very different to the austere frontier fortress shown here.

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THE FIRST SPACE-AGE WEEKLY

Week Ending 16th June, 1956. No. 9.

A 'News of the World' Publication.

4½D

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in MOON-BASE PATROL

THE "HAWKINS"- REPAIRED AFTER THE BATTLE- IS READY IN THE MOON-BASE HANGAR FOR THE NEXT ADVENTURE- "RENEGADES OF SPACE"

JUNGLE of SPACE

By **CONRAD FROST** Illustrated by **WINSLADE**

Start the story here:

Captives aboard an asteroid approaching the inhabited Martian satellite, Phobos, Gi-Gi Nash and his two companions, Terry Carstairs and Timba Kellina, learn something both of the past history of the Martians and of their future plans.

Invaded 4,000 years before by the Teages who came from Interstellar space, the Martians used 'the ultimate weapon of destruction', with the result that their planet ceased to be habitable.

The survivors of both the Martians and the Teages fled to the many small satellites of Mars where they have since lived, the Teages as a slave-race.

But the orbital speed of the satellites is decreasing and eventually all must crash into the mother planet. Needing another home, the Martians plan to invade and conquer Earth. Towards this end they propose, by a very simple operation, simple to them because of their skill in plastic surgery, to 'convert' Martians into Earthmen and to land an advance Fifth Column on Earth.

Gi-Gi does not suspect that two Americans aboard the Asteroid, Buford and Olsen, supposedly prisoners like himself, Terry and Timba, are in fact the first Martians to be 'remodelled'.

Their immediate interest is focused on the satellite for here they are to meet 'The Predanamite', an apparently immortal Martian who has lived for over 4,000 years, and whose decision it is that Earth is to be invaded.

THE asteroid was now pacing Phobos through space, barely a mile above the satellite whose short, four hour day had just dawned. As they watched through the crystal dome Gi-Gi and his companions saw their own shadow creeping perceptibly across that exciting, alien landscape.

"Look down at those roads!" whispered Terry in awe. "Look at the traffic on them and the speed at which it is travelling. Why do you suppose the city is built over by a transparent dome? Does it mean that we're going to need breathing apparatus, or space suits of some kind on Phobos?"

"Short days and nights. And not only is Mars 37 million miles further from the sun at perihelion, but its variation of distance is 26 million miles against Earth's variation of three million. I'd say the dome was thermal and that life here is only possible in a glass-house."

"Quite correct," said Phidag from the door. "But you will have plenty of time to see and discuss our civilisation and way of life later. There are the aircars coming up."

They came in formation and it was Timba, glancing out at them before he followed Phidag and the others, who commented:

"Factual foundation for the flying carpet legend, Gi-Gi? What do you think?"

The Martian aircars were, in fact, ski-like platforms with a curved and streamlined toe, on which a centrally placed cabin dome was built. But the appearance of a carpet heightened by two 'ripples' that transversed the platform.

"You mean that the early Martian raiders of Earth took some of these craft with them for surface exploration and that that began the Middle East stories of flying carpets? I doubt it. These things are designed for conditions where not much lift is needed."

"Still, the Martians gave the Mountains of the Moon their name. Who knows how many legends and superstitions on Earth spring from their early visits."

They were all following Phidag down the corridor and now they came to the intersection where stairs led down to the Teage quarters and upwards to a surface airlock.

Like an Air Terminus

PHIDAG took them up, through sealing doors that opened at his approach into a large, circular chamber like a reception lounge. They realised that this air-lock was more than a place giving access to the surface of the asteroid. It was, if such a thing were possible, the main entrance to the asteroid, to be compared with the lounge in the Terminal Building at London Airport, or the foyer of some great, sky-scraper hotel.

When the asteroid was permanently stationed in the Martian sky as a kind of overflow city for the Martians, this place would probably be as busy with movement and people as a railway city terminus on Earth.

Further doors opened as Phidag crossed the chamber, and the chill of an arid cold burnt their skin. Breathing was extremely painful and Buford and Olsen seemed to be in real trouble. Buford clapped both hands to his face and rocked in obvious pain. Olsen had a look of disbelieving surprise on his face, then he gasped:

"Let's get out of this. Let's get out fast."

"It's not as bad as all that," said Terry. "Don't take such deep breaths. Bit painful between the eyes if you do."

Beyond them an area of the asteroid's surface about as large as a cricket pitch had been levelled, and the aircars came climbing over the close horizon as if topping the crest of a hill. As they touched down, the purpose of the transverse 'ripples' became clear. Underneath these were accommodated wheels for surface travel.

They landed in formation, wheeled round and regrouped into line astern. As the leading vehicle approached the waiting group, they saw that the domed cabin contained a pilot's compartment, occupied by a Teage, and a rear compartment with seating accommodation for about six passengers.

The aircars slewed round into parking positions, close to one another. Some had passengers who disembarked and sauntered over. The passengers were all Corypheans. Most merely nodded to Phidag, stared curiously at the rest of his group, and then went into the asteroid. Others called across to him as they went in.

"Hear you've had a successful journey, Phidag. Congratulations!"

"So these are the specimens, eh? There's some betting going on that you'll get promotion to command of a satellite for this job. Delion's going, I hear. Nice place to be that. Remember me if you get the job and want any staff men."

"Saw your wife this morning, Phidag. Told me to tell you not to be longer than you could help at the Palace. Said: 'Tell him to remind the Predanamite that he's a married man.' The nerve women have, eh?"

One of the Corypheans came over without speaking and stared intently but briefly first at Terry, Gi-Gi and Timba, and then at greater length at Buford and Olsen, both of whom were still protecting their noses against the sharp, burning air.

"Breathing trouble, eh?" he said. "Not surprised. Expected it. Told Mannij so, but he wouldn't listen."

He shrugged and went on. Phidag glared at him with an air of annoyance Gi-Gi could not quite understand, then beckoned them to follow him to the nearest aircar.

Once inside the domed car, the discomfort of breathing passed. The car raced forward, lifted and became airborne silently, and then dived round the surface of the asteroid, heading towards Phobos.

They seemed to float down, and Gi-Gi judged their speed as not being much more than about 30 m.p.h. In all, their journey took them about five minutes, but those minutes were so packed with first impressions, that they seemed much longer.

Now they could see that the great thermal transparent dome that encased the

FLYING SAUCERS

By W. J. McMurray

ARE FLYING SAUCERS real? After reading the book, REPORT ON UNIDENTIFIED FLYING OBJECTS, by Edward J. Ruppelt, formerly head of the American Air Force organisation set up to investigate these space phenomena, the answer is: Yes, they *are* real.

But are they interplanetary space-ships? There is no official "proof" that they are —but plenty of opinions (many from well-known people) that they must be.

Mr. Ruppelt is careful to sift out the reports of sightings of UFO's—hoaxes, ground reflections, light from planets, faked photographs, and so on, and these are the official findings: *Balloons:* 18.51 per cent.; *Aircraft:* 11.76 per cent.; *Astronomical Bodies:* 14.20 per cent.; *Others:* (searchlights on clouds, birds, blowing paper, reflections, atmosphere inversions, etc.) 4.21 per cent.; *Hoaxes:* 1.66 per cent.

Reports with insufficient data to evaluate: (in addition to those initially eliminated) 22.72 per cent.; *Unknowns:* 26.94 per cent.

So the UFO's win, with nearly 27 per cent.—food for thought, even for the scientist! But who made the reports that ended in these percentages? Mr. Ruppelt and his crew of "lost sleep" investigators worked hard to give these figures: *Pilots and air crews* 17.1 per cent., from the air; *Scientist and engineer* 5.7 per cent.; *Airport control tower operators* 1 per cent.; *Radar reports* 12.5 per cent.; *Military and civilian observers* 63.7 per cent.

Where do these U.F.O.'s come from?

PILOTS, with thousands of hours' flying time, are not given to day-dreams or exaggerated reports. Yet all those who have tried to intercept a "Flying Saucer" have been awed by the experience.

In each case, the "cat and mouse," game, miles above the Earth, has followed more or less the same pattern. The Earthmen have flown fast and high, but have never been able to get nearer than 3 miles to the strange craft. When the 3 mile limit was reached, the UFO shot off, at a fantastic speed and at an incredible angle (180 degrees) so that the fastest aircraft we know could not turn quickly enough even to see its quarry vanish. "Like a light being turned off" is how most people describe this vanishing trick.

Boy Scouts' story

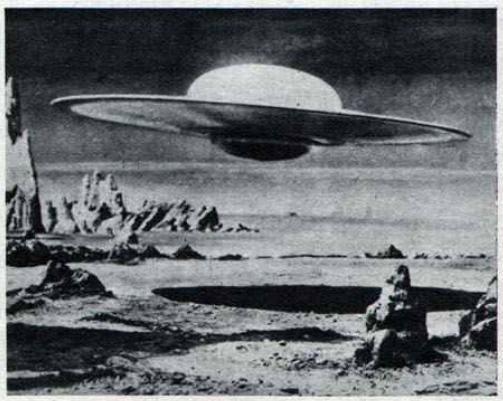
IN Chapter 13 of his book, Mr. Ruppelt tells of the American Scoutmaster and three boy scouts who reported seeing a UFO in Florida. The scoutmaster and the boys were "riding along when the scoutmaster said he noticed a light off to his left in the pines." He thought someone needed help, so he decided to investigate. He told the boys to go to a nearby farmhouse for help, if he did not return in 15 minutes . . . then "he started pushing his way through the waist-high tangle of brush" . . . He gradually became aware of "an odd odour" —then of heat . . . but thought nothing of either until later.

Eventually he became "consciously aware of the odour and the heat. Both became more noticeable as he stepped into the clearing. In fact, the heat became almost unbearable or, as he put it, 'oppressively moist, making it hard to breathe'. He walked a few more paces and suddenly got a horrible feeling that someone was watching him . . ."

"Then he suddenly saw that almost the whole sky was blanked out by a large dark shape about 30 feet above him . . . he shone his light up at the edge of the object and got a quick but good look. It was circular-shaped and slightly concave at the bottom. The surface was smooth and greyish colour . . . the upper part had a dome in the middle, like a turret. The edge of the saucer-shaped object was thick . . . between each vane was a small opening, like a nozzle" . . .

Then, drama . . . "a small ball of red fire began to drift towards him . . . he passed out."

This was a good story, but Mr Ruppelt and his fellow-investigators went through it with a small tooth-comb, as in every-



Not a real flying saucer, but a still from the M.G.M. film "Forbidden Planet".

thing else they did.

Was it a hoax? Some things pointed to that answer. A Geiger counter was used to check over the Florida Woods, but it "found nothing, just a plain unmagnetized, unradioactive, unheated, common, everyday knife", which the Scoutmaster had been carrying.

The Scoutmaster had reported burns to his own person, and holes burned in his cap . . . Yet, when the experts examined the ground, they found the blades of grass themselves were not damaged—"they had never been heated, except on the extreme tips of the longer blades"—but *the roots were charred!*

There is one way to explain this, as the author observes: "Since the blades of grass were not damaged and the ground had not been disturbed . . . the soil could have been heated. It could have been done by induction heating . . . A rod of solid metal or any electrical conductor, when subjected to an alternating magnetic field, has electromotive forces set up in it. These electromotive forces cause what are known as 'eddy currents'. A rise in temperature results from 'eddy current'."

Read this book and weigh up the "Flying Saucer" situation for yourself.

Here is the author's summing up:

Maybe the final proven answer will be that all of the UFO's that have been reported are merely misidentified known objects. Or maybe the many pilots, radar specialists, generals, industrialists, scientists, and the man on the street, who have told me: "I wouldn't have believed it either if I hadn't seen it myself," knew what they were talking about. Maybe the earth is being visited by Space-ships. Only time will tell.

"Report on Unidentified Flying Objects", by Edward J. Ruppelt (Gollantz, 18s.).

Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

☆ 🪐 ☆

THE MOON SURVEY

TO be of any use the Lunar base will have to be more than a temporary affair, and a permanent base will take time to build and a lot of hard pioneering. As soon as possible a survey will have to be undertaken for essential raw materials, to be turned into essentials for life on the moon. The two most immediate necessities are food and oxygen. A very limited amount can be rocketed off the earth via the satellite station, but every pound of freight carried increases the difficulties of the project tremendously.

Experts consider that the surface of the moon will be seamed with crevasses, strewn with great boulders and probably deep in dust in places where it could accumulate. No form of soil or vegetation is present to modify the roughness of the surface.

Walking Vehicle

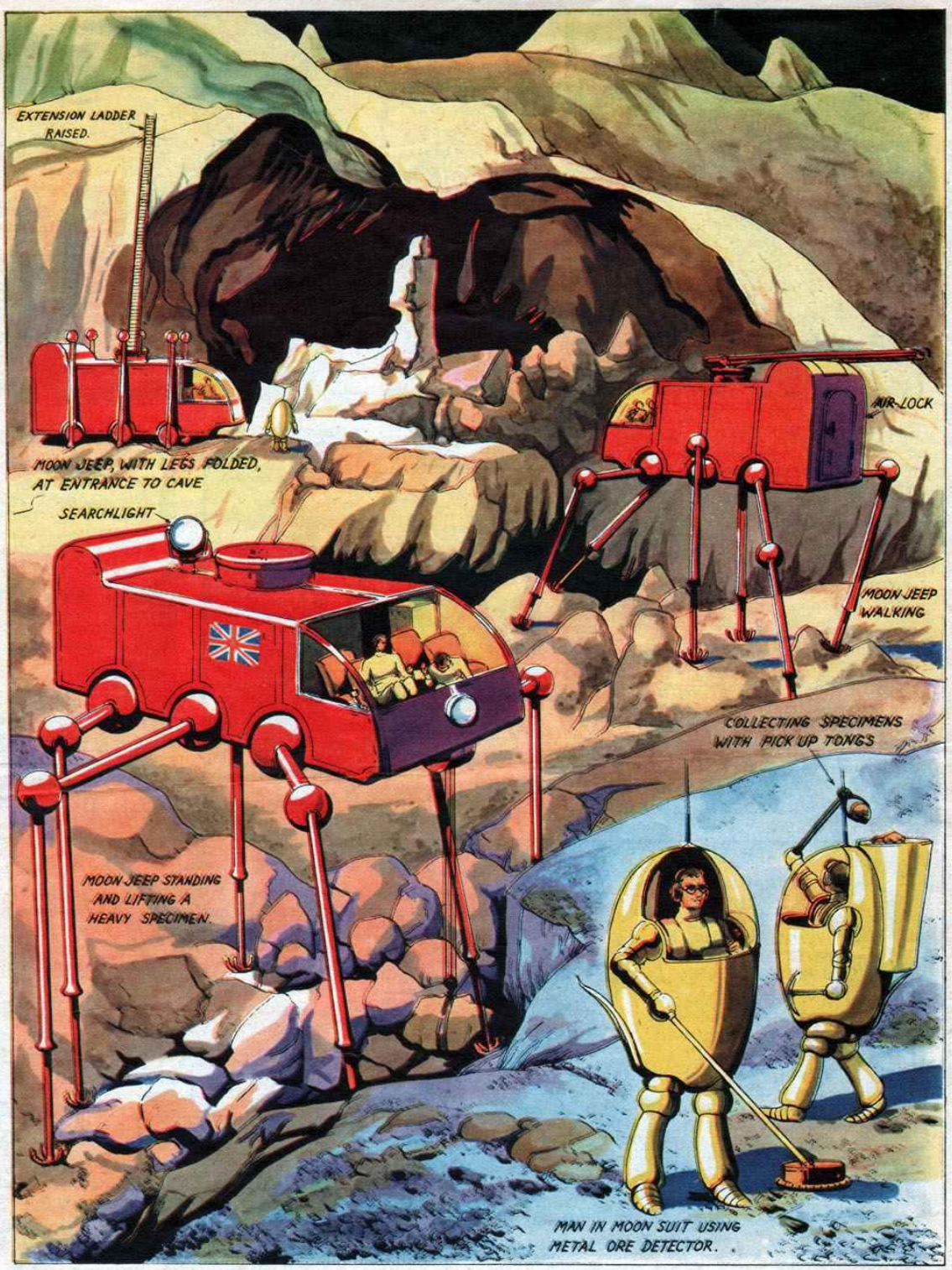
TO combat these very difficult conditions it has been suggested that an entirely new principle of traction be used, and a walking vehicle developed. The fewest number of legs to give stable support at all times is six; two pairs of tripods moving alternatively. It should not be impossible to produce this lunar "jeep" especially as the pull of gravity being one sixth that of earth, the legs will be light and easy to drive.

The body must be pressurised, insulated against heat, cosmic and other rays and the windows must filter out the ultra violet part of the sun's light to prevent burn. Air locks are essential on these vehicles. It is unlikely that three of these jeeps would be available at the beginning of the pioneer period.

Moon Suits

FOR any work outside the jeeps a moon suit would be absolutely necessary. This too has to be fully pressurised, and proof against cosmic and other rays, also insulated and temperature controlled. As there is gravity to be overcome (although but one sixth of the earth's) it cannot rely on a little jet to move it around as the true space suit can. But it will be possible to walk around in these suits as their weight will be very little and mechanical handling devices will add to their usefulness.

The illustration shows a survey party at work. They have come across a great cave that may be converted into their underground station provided it can be rendered airtight at atmospheric pressure. Men in moon suits in the foreground are using a detector to search for metal ores and are taking samples for assay. The "moon jeep" can be fitted with a scaling ladder such as that on the one in the background which is in its still position with legs folded.



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THE FIRST SPACE-AGE WEEKLY

Week Ending 23rd June, 1956. No. 10.

A 'News of the World' Publication.

4½D

ROCKET

Edited by DOUGLAS BADER

CAPTAIN FALCON in "RENEGADES OF SPACE"

And inside—

FLASH GORDON
JOHNNY HAZARD
BRICK BRADFORD

AND A THRILLING SERIAL— "JUNGLE OF SPACE"

BRICK BRADFORD

BY CLARENCE GRAY

• AT BRICK'S REQUEST, CAPTAIN PERO HAS SUPPLIED HIM WITH A GRAVICOPTER TO INVESTIGATE THE WILDERNESS BEYOND EXODUS PASS •

WHOEVER IS BEHIND THESE SATELL-CELL INVASIONS OF OSTAR MUST HAVE A SUBTLE PLAN. PERHAPS THERE IS AN ANSWER IN THE FOREST WHERE THE CAPTIVE VICTIMS SEEM BOUND TO GO UNDER THEIR SPELL.

1

THE SILENCE OF A GRAVICOPTER IS TO MY ADVANTAGE. I'LL JUST SCOOT BEYOND EXODUS PASS AND — WOW! WHAT A WILDERNESS! A MILLION PEOPLE COULD BECOME LOST IN THIS EXPANSE!

2

MY HUNCH IS THAT IF THESE PEOPLE ARE ANSWERING TO A MASTER — THERE MUST BE A RENDEZVOUS SPOT IN HERE SOMEPLACE! BUT WHERE? THERE'S NOT A BREAK VISIBLE IN THIS PRIMITIVE GROWTH!

3

• BUT WITH THE COMING OF NIGHT, BRICK'S SEARCH IS REWARDED •

HEY! A BLUE GLOW DOWN THERE — SHINING UP FROM THE FOREST! THIS DESERVES A LOOK-SEE!

4

• MEANWHILE, ANOTHER CLOUD OF SATELL-CELLS, SEEKING VICTIMS, IS ABOUT TO RAIN A NEW STORM OF HAVOC UPON OSTRONIA •

5

1-2

CONTINUED

Strange AND True

A DREAM OF THE FUTURE IS TO PRODUCE THE PERFECT AMPHIBIAN — A CRAFT FOR AIR, SURFACE & UNDERWATER OPERATIONS; ABLE TO LAND ANYWHERE. AN AMERICAN PAPER HAS PRODUCED A DESIGN THAT IS SIMILAR TO THE ONE SHOWN ON THE LEFT.

IN THE INSECT WORLD THE PERFECT AMPHIBIAN ALREADY EXISTS. A MINUTE WASP, WITH A * NAME MANY TIMES AS LONG AS ITSELF, FLIES IN THE AIR — WALKS ON THE WATER AND SWIMS DOWN BELOW THE SURFACE TO LAY ITS EGGS IN THOSE OF WATER BUGS. ALL AS SHOWN IN THE RIGHT HAND DRAWINGS.

* 'PRESTWICHIA AQUATICA' LENGTH $\frac{1}{20}$ INCH

Across the Frontiers of Space

by Commander J. YUNGE-BATEMAN, R.N.

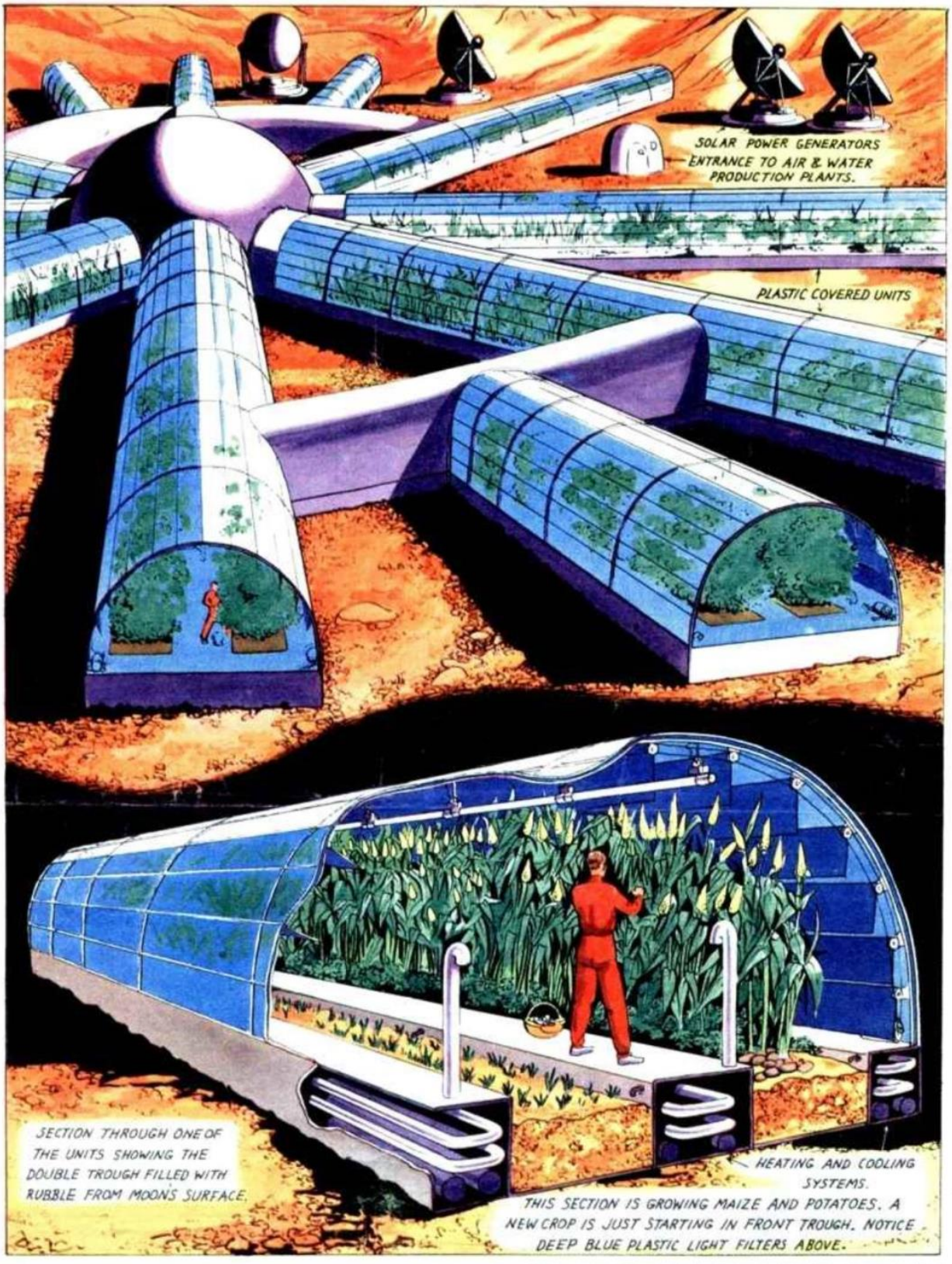
☆ 🪐 ☆

FARMING ON THE MOON

IF the Lunar Base is to be of any use at all it will have to be developed to become self-supporting. It will be quite impossible to ferry out supplies of raw materials and this includes air, water and food. Air and water sufficient for the colony must be extracted from local minerals, difficult but possible. Food can be grown under lunar conditions by the development of soil-less cultivation or hydroponics because of course there is no soil on the moon. Broadly speaking, crops can be grown without soil, using water with the correct chemicals added. The roots are supported in tanks of crushed rubble kept immersed in this solution. This technique is being developed for farming on the Earth but it also can be adopted for Lunar purposes.

Underground Industry

PLASTIC tubes of the cross section shown and built on the unit principle can be fitted up on a selected surface site. The troughs in the floor are filled with Lunar rubble. Air and water will have to be supplied artificially and for this purpose an underground industry must be developed. The layout of the farm would resemble a wheel with the control offices at the hub. The spokes can be extended and increased in number as the farm grows. Solar generators must be established to supply the power necessary for the water and air production and conserving mechanisms; also heating, cooling and lighting systems are required, to adjust conditions inside the plastic units. Light filters to screen the plants from the fierce sun are also indicated. We now have a closed, controlled system in which plants can be grown, reaped and processed in spite of the long dark intensely cold lunar night, and the fierceness of the sun during light hours. As time passes the possibility exists of developing new strains of plants suitable to Lunar conditions and greatly increased efficiency in farming can be expected. In fact, starting from the very beginning in this way it should be possible to control development and eliminate all harmful pests, thus getting much higher yields than Earth farming.



Perfect Weather

IN these farms also the weather is always under control. No wind or rains to beat down grain crops or frosts to nip fruit in the bud occur and it should be possible to harvest two or possibly three crops in a year under these conditions. In fact, if properly undertaken lunar farming should produce results much in advance of anything we have so far obtained on Earth even in the most satisfactory conditions and a time may come when lunar fruit and lunar crops will be supplied to the Earth. The journey could be done in a week. In any case to make the lunar base efficient it will have to be developed as fully as possible. No efficient space exploration can take place from a base, living at a base subsistence level in extreme discomfort and danger. These occupied cells of life in space will start a new way of living in an entirely artificial atmosphere and environment. To succeed the conditions must be good, and once started an entirely novel method of subsistence will be established.

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THE FIRST SPACE-AGE WEEKLY

Week Ending 30th June, 1956. No. 11.

A "News of the World" Publication.

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ADVENTURE STRIPS and STORIES

CAPTAIN FALCON in **"RENEGADES OF SPACE"**

And inside—

FLASH GORDON
JOHNNY HAZARD
BRICK BRADFORD

AND A THRILLING SERIAL— **"JUNGLE OF SPACE"**

Across the Frontiers of Space

by Commander J. YUNGE-BATEMAN, R.N.

☆ ☆

THE LUNAR BASE GROWS UP

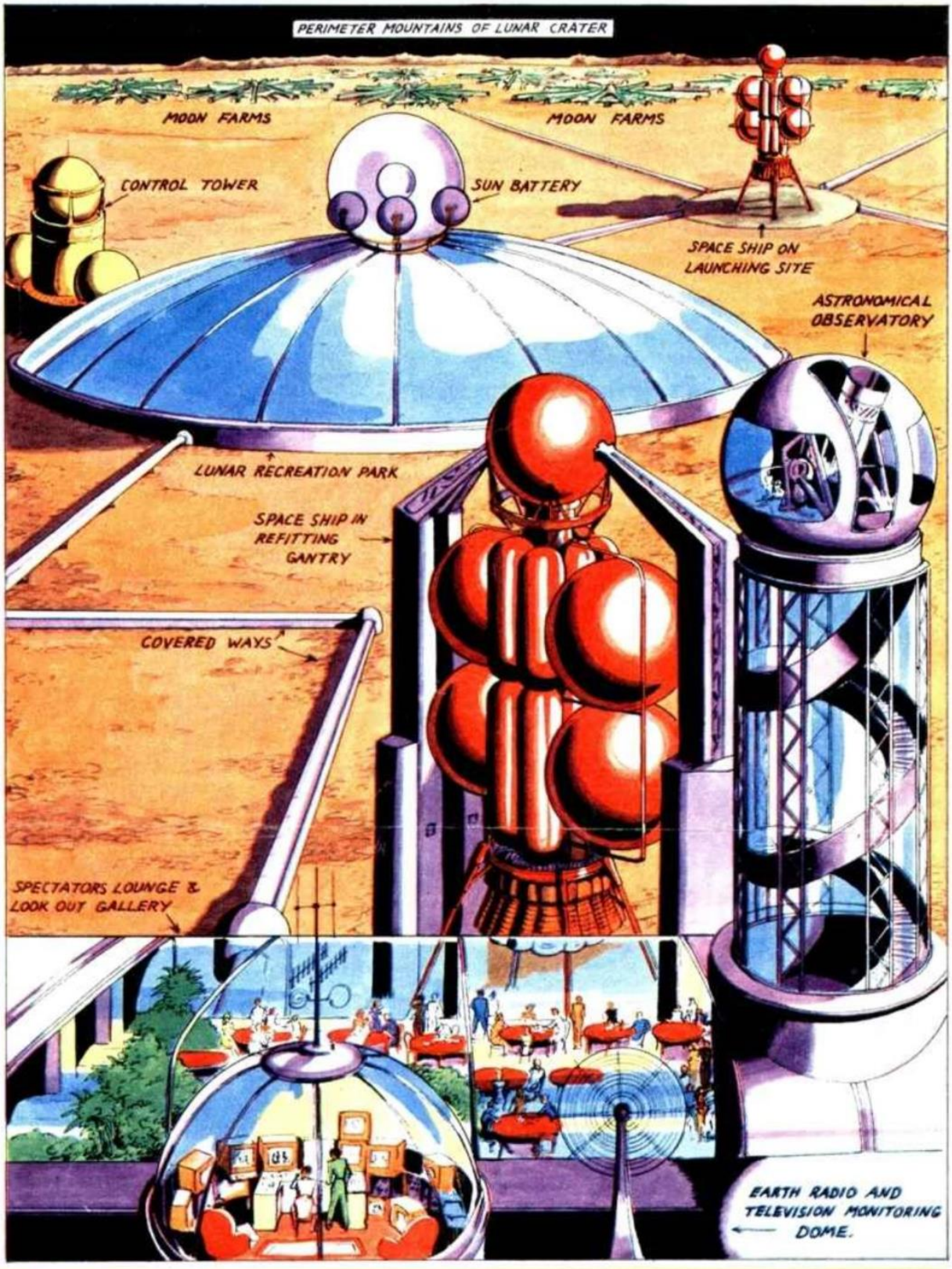
THIS week the picture is to give an idea of the Lunar Base once it becomes firmly established and self-supporting. This latter is most important, as it will no longer be necessary to transport essentials by Space Ship, and instead of the narrowest survival margin the base will begin to develop on its own resources. This means that the problem of producing air and water has been solved and the necessary industries started and functioning with sufficient output to produce a steady increase of supplies to serve the increasing size of the colony. As regards food, some varieties will have to be imported for a long time but with the moon farms started as was described last week a large supply of grain and vegetables of all sorts should be available.

Moon Farms

NOW that a certain amount of air is available, chickens run on the battery system will be easy and efficient to keep. As time passes the number of moon farms will increase and the skill in moon agriculture will improve. Recreation and relaxation for the moon colony will become a matter of great importance and this side will have been most vigorously pushed forward. In the picture the Base is shown as situated on a plateau inside a lunar crater. The mountains that surround it are just visible in the distance. Next come the group of moon farms and then the take-off and landing area.

Moon has Atmosphere

IT is now thought that the idea that the moon is entirely without an atmosphere is erroneous and that actually a very attenuated atmosphere does exist. Though useless for air breathing mammals it is sufficiently dense to act as an efficient meteor screen. The fear therefore of incessant bombardment from space is no longer present, and quite a lot of surface development will be possible. It will mean that covered ways can be used instead of a series of tunnels. Also transparent roofs suitably fitted with light filters and diffusers will make it possible to make the living conditions much more homelike to the moon dwellers. The great dome in the centre, covers the recreation park. It is worked on a similar principle to the Moon Farms, the low force of gravity in the moon making the great dome a practical feature. The low force of gravity makes staircases an economic rival to lifts. Young spacemen will run up flights of stairs with small effort. The astronomical observatory is shown with a spiral staircase for this reason.



Contact with Earth

ANOTHER important feature is the Earth Radio and Television monitoring system. This will be used both for entertainment and also for administration and executive purposes. And here for the moment we could leave the problem of lunar development, without taking notice of the vital problem of the possibilities and importance of international control and co-operation in lunar affairs. It is quite certain that some form of agreement must be reached if anything is to be done in the way of lunar development, or indeed if dangers far worse than an invasion from outer space are to be avoided.

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 7th July, 1956. No. 12.

A 'News of the World' Publication.

ROCKET

ADVENTURE STRIPS and STORIES

USING THE HAPLESS COMMODORE ERICKSON, C.O. OF MARS-BASE TWO, AS A DECOY, **ZAND** LURES CAPTAIN FALCON INTO LANDING "THE HAWKINS"..... BUT AS THE GREAT SHIP GLIDES DOWN TOWARDS THE APPARENTLY PEACEFUL AND DESERTED BASE, CONCEALED ROCKET GUNNERS OPEN FIRE....

THEY'VE *MISSED!*... MY GUNNERS HAVE *MISSED THEM!!*

CAPTAIN FALCON in "RENEGADES OF SPACE"

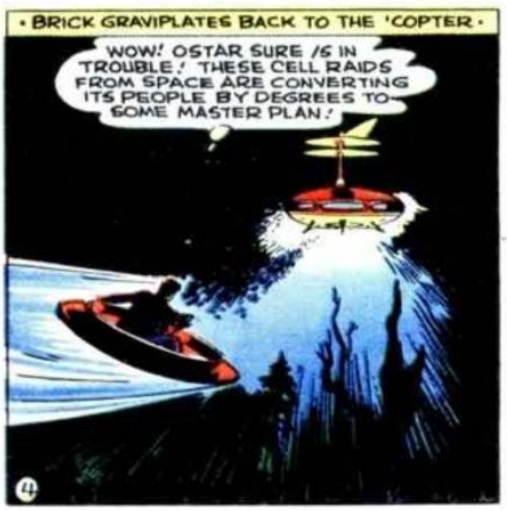
And inside—

FLASH GORDON
JOHNNY HAZARD
BRICK BRADFORD

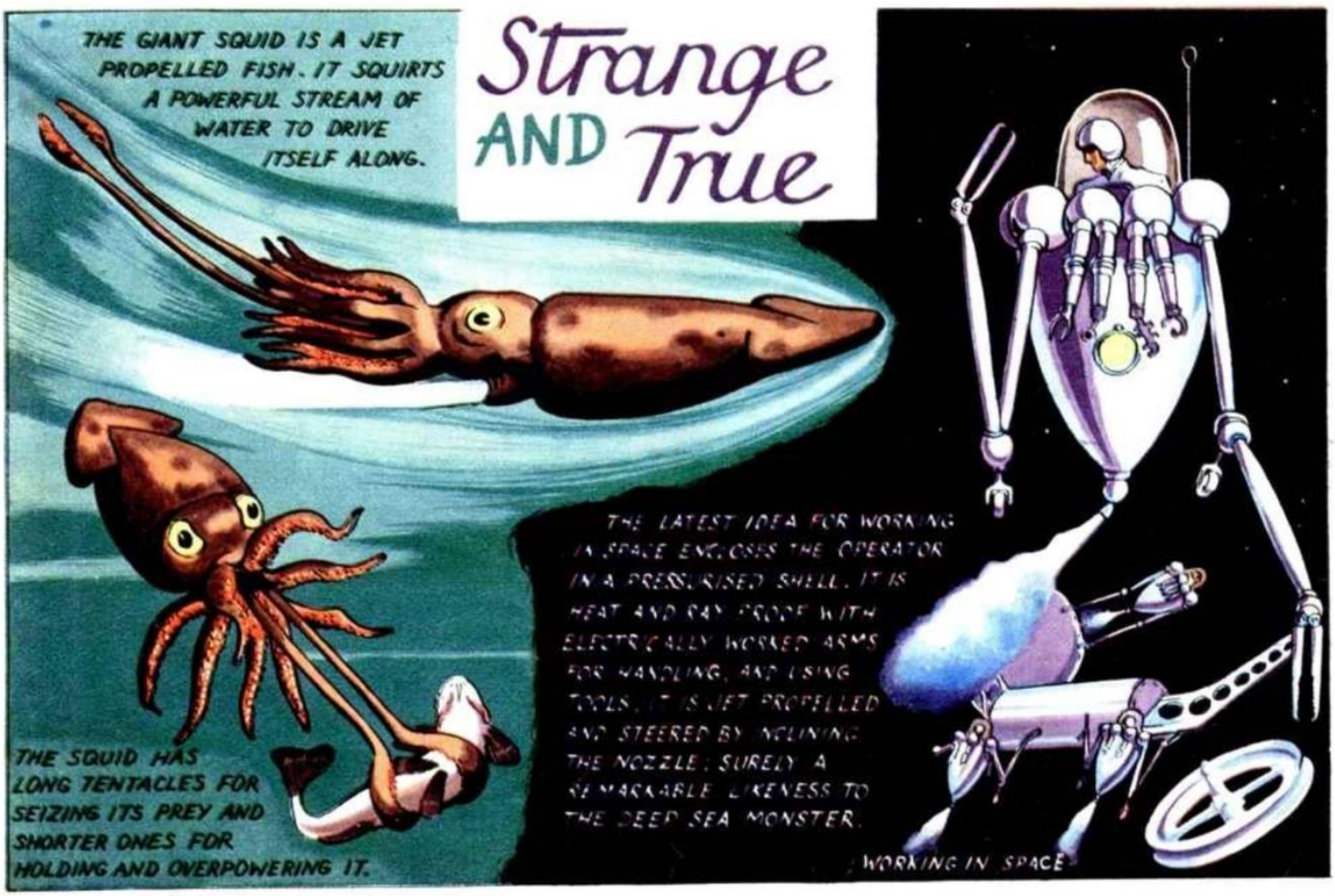
AND A THRILLING SERIAL— **"JUNGLE OF SPACE"**

BRICK BRADFORD

BY CLARENCE GRAY



Strange AND True



Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

☆ 🪐 ☆

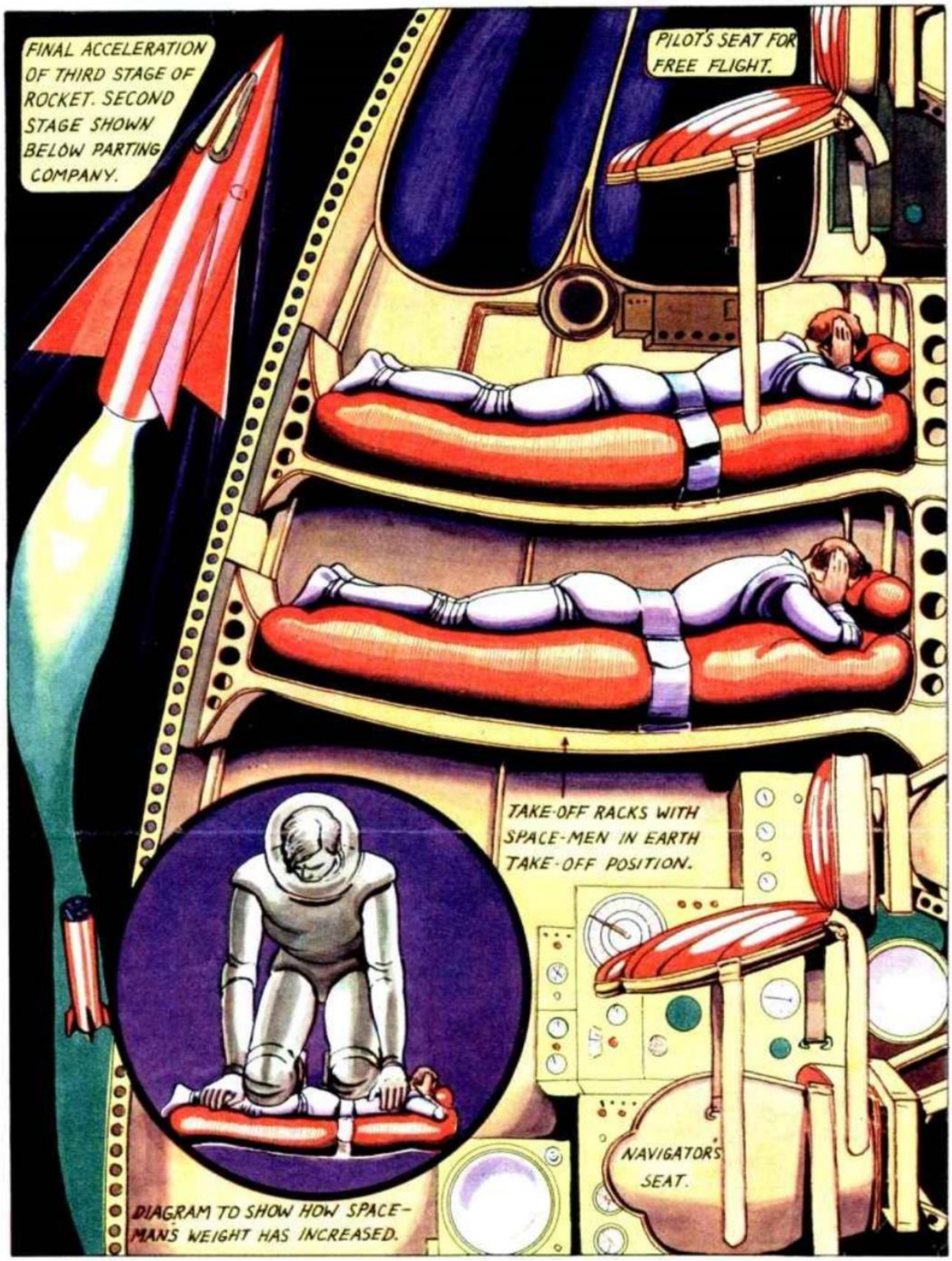
Satellite Rocket Take-Off

ONE of the two most critical periods of a space journey is dealt with here. This is the take-off from the Earth, quite the most unpleasant and physically distressing ordeal to be borne by the Space traveller.

The trouble is that the acceleration of the three-stage satellite rocket is very high and this brings terrific strain on the crew. Similar strains are experienced by pilots of high speed planes when manoeuvring, causing black-out on turns if taken too abruptly. The rocket will produce considerably worse conditions than anything so far experienced and so very special precautions will be necessary. Von Braun has stated that an acceleration of 9 G's may be necessary. This means that the normal gravitational pull will have been increased by nine times, a terrific force. The crew will therefore be quite incapable of controlling the ship during this period, for their normal weight has increased nine times.

Electronic Control

SO the rocket will have to be electronically controlled during this whole operation, the first and second stages being jettisoned and the third stage brought to its correct speed, course and position before the crew can take over. Now the effects of acceleration on weight are best borne in a prone position, as the blood is not drained from the eyes and brain, causing black-out and unconsciousness. So special gravity couches are supplied for the crew who will take up their position for 'blast-off' on them, and fasten safety straps. The picture shows two of the crew 'sticking it out' on the take-off. Notice that their couches are horizontal for the take-off, but the normal control seats are at right-angles to them so as to face forward for free flight.



Powerless to Move

THE time taken on this part of the flight is luckily not so very long. But it will be all too long for the men enduring the experience. Roughly the first stage has finished and dropped off at 80 seconds, the second stage goes after a further 120 seconds. The third stage fires for another 80 seconds before the correct speed is built up. This gives the crew about five minutes during which they are immobilised by their own terrific weight caused by the acceleration. The small figure inset in the picture is to emphasise this aspect. It is the spacemen's own weight increase that is pressing them down, like a giant kneeling on their bodies. There is also plenty of time for mental anxieties to add to their troubles. They are powerless to move a finger to help themselves while they lie and hope that all goes well with the distant control system, and that no one sitting comfortably in the control tower is going to make a mistake. Once the acceleration is over they will find themselves quickly transferred to a condition when gravitational pull is zero and their weight is nothing. This is likely to cause a lot of mental distress for a time as the normal balancing reactions of the body are all thrown out of gear. However in spite of discomfort and distress the crew must now take over control of the Rocket. They have to correct all errors that may have accumulated during the control from the earth station and take the correct steps to set a course to the Satellite Station which is their target. Next week we will consider the final stage, namely the return to the Earth Station.

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 14th July, 1956. No. 13.

A 'News of the World' Publication.

ROCKET

ADVENTURE STRIPS and STORIES

CAPTAIN FALCON in "RENEGADES OF SPACE"

And inside—

FLASH GORDON
JOHNNY HAZARD
BRICK BRADFORD

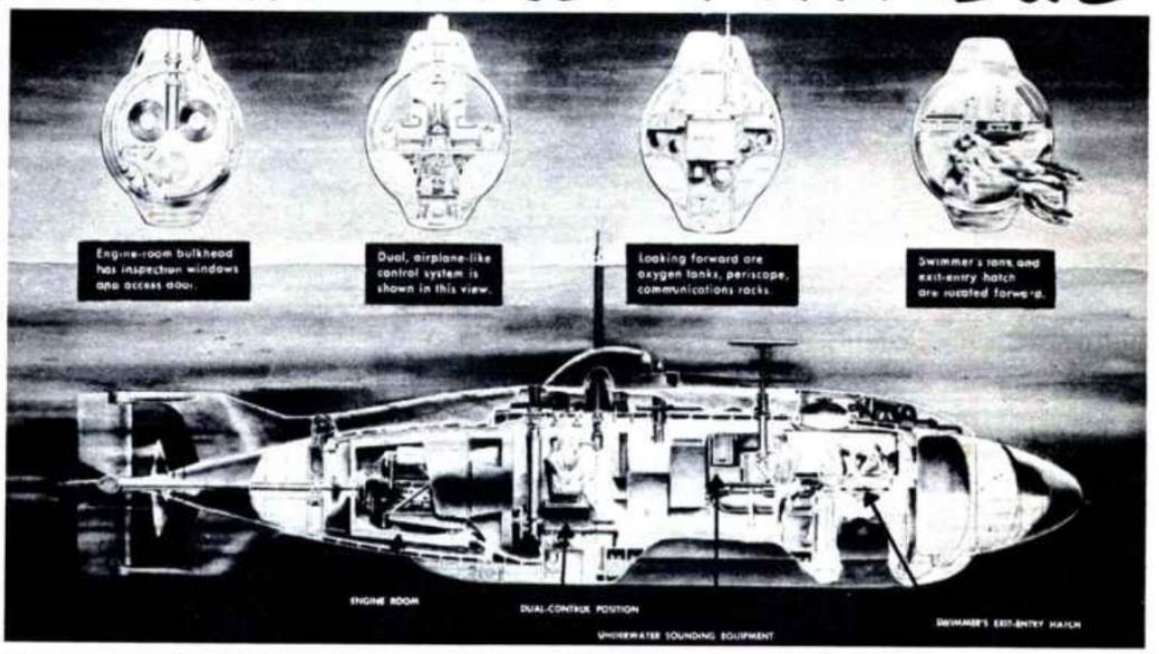
AND A THRILLING SERIAL— "JUNGLE OF SPACE"

FOUR MEN RUN HALF-PINT SUB

DURING World War II, the midget submarines did heroic and valuable work. It was said that they made the worst of two worlds, combining the minimum of space with the maximum of discomfort.

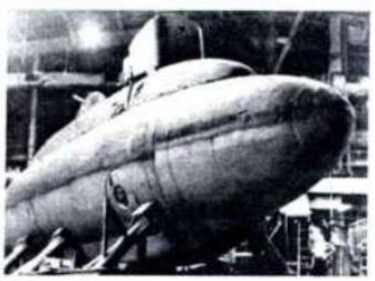
Baby submarines like the one shown here move silently in the water and once inside an enemy harbour could launch missiles with atomic war-heads and wreak havoc among the shipping.

Range is unimportant as they can be transported overland or by sea and when dis-assembled, by air.



The picture on the left shows the portability of the 'midget'. It is easily lifted by crane and transferred to road transport. Wrapped in its tarpaulins it assumes the appearance of a whale.

Below: Harbour tests being made prior to deep water trials. Crews have to be specially trained and, for this exercise, those bearing the name 'Tich' among their friends are the first choice, other things being equal.



While quarters are cramped, the designers have squeezed in the maximum comforts — bunks, reading table, air conditioning and temperature control. There is even a hot-plate for the preparation of warm meals. The power plant is insulated to cut down noise in the cabin. Dual control permits one-man operation of the submarine. Left: The vest-pocket sub. in an air hangar. It weighs 25 tons, is 50 feet long.

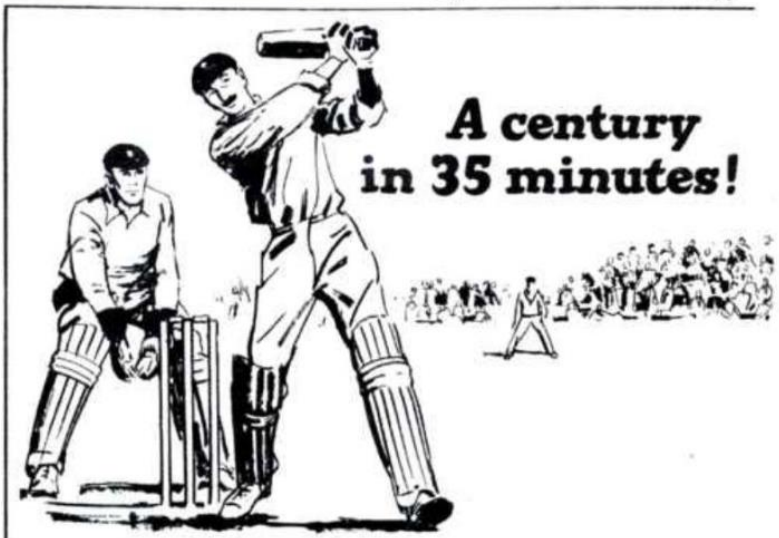
OUR SOLAR SYSTEM: URANUS

MEAN distance from Sun: 1,782,800,000 miles; Diameter: 32,000 miles; Orbital velocity: 4.2 miles per second; Length of year: 84.02 years; Period of rotation: 10 hours 40 minutes; Satellites: 5.

As we go further away from the Sun it becomes more difficult to obtain accurate information about our outer neighbours. Uranus is no exception, being covered by a dense atmosphere mainly of methane thousands of miles deep. But we do know that its axis is tilted at more than right-angles to the Sun and as its five moons revolve in the plane of its equator this makes their orbits almost vertical to the planet's orbit.

Its characteristics are similar to the other outer giants, revolving rapidly on its axis once every 10 hours and 40 minutes, and it has a surface gravity slightly less than that of Earth.

NEXT WEEK: THE MOONS OF URANUS



A century in 35 minutes!

It is an August afternoon at Northampton, where Northamptonshire are playing Surrey. The Surrey score reads 448 for 5 wickets when all-rounder P. G. H. Fender strides out to bat. After just 42 minutes more of batting Surrey declare—at the huge score of 619 for 5. P. G. H. Fender has made 113 not out, actually completing his century in 35 minutes! This hurricane innings took place in 1920, and it still stands as the fastest century ever made in first-class cricket. A record that has lasted unbeaten for 36 years!

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Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

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RETURN TO EARTH

IF the take off from the Earth station is tricky and dangerous, the return trip is equally risky, but for a different reason. Before the departure for Earth, the third stage Rocket is moving at the same speed as the satellite station, and is in orbit with it. To return, the pilot sets course in the opposite direction and gives a blast on his motors sufficient to reduce his absolute speed by 1,000 miles per hour.

He will now not be moving fast enough to stay in stable orbit, and will follow a descending elliptical path that will take him in a gentle curve to the edge of the Earth's atmosphere. A gentle curve but not a gentle speed. By the time he reaches it the force of gravity will have increased his speed to 18,500 miles per hour. This speed is so high that if the rocket was in the normal flying position it would bounce off the atmosphere into space again.

Inverted Flight

SO the pilot turns his craft at the critical moment and enters the atmosphere upside down. The wings will now keep the Rocket on a curving course towards the Earth. The craft will at once start to heat up at least to a cherry red. If the temperature rises too high the metals of the craft will soften and lose shape and the whole will become a flaming meteorite and burn out absolutely.

So the pilot has the job of seeing that as soon as the structural temperatures rise to a dangerous level he must flatten out into rarer atmosphere until the temperature falls, and thus jockeying his ship allow the friction on his swept back wings to slow him down, until he can safely glide in lower.

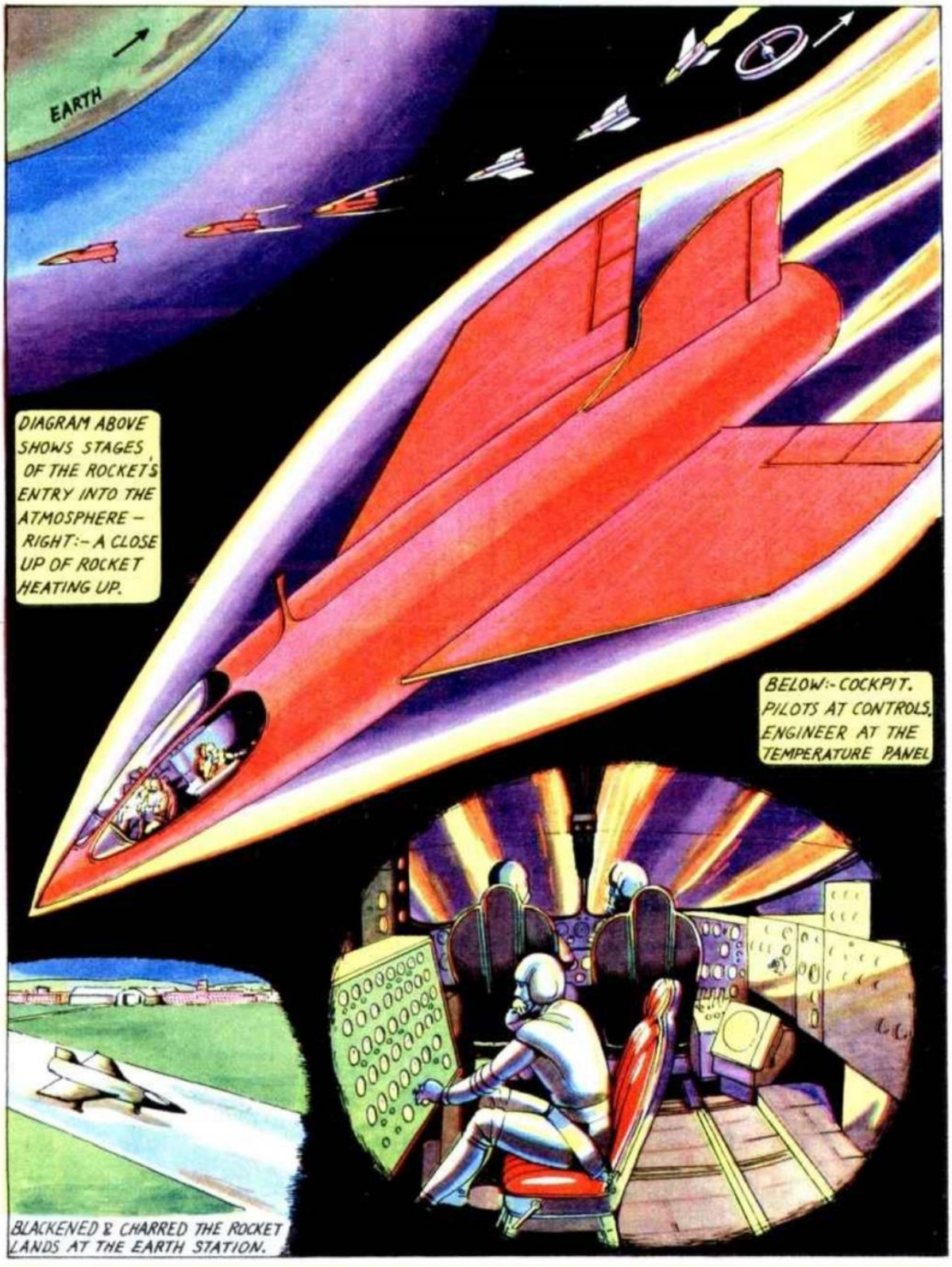
Gradually his speed will drop and so, too, his temperature, until he reaches the stage at which he can turn his ship back into a normal flying position. So he coasts down in a gentle curve into the denser atmosphere until he has only the speed of a normal airplane. With a touch now and again on his rocket motors he heads for the Earth Station and lands at the speed that is now considered reasonably safe.

Terrifying Manoeuvre

THE diagram at the top of the page illustrates, at its simplest, this terrifying manoeuvre. The insulation of the Rocket will have to be very carefully considered but it can be managed. Alloys can be applied to the outer skin and wings in such a way that but little of the heat developed will penetrate to the interior. The windows will be made of heat resistant glass and can be cooled by liquid circulation. Another idea is to cover the leading edges and nose with wood veneering.

Happy Landing

AS the wood burns the charred wood acts as a highly efficient insulator preventing the heat from destroying the metal surfaces. By the time the wood is destroyed the craft will have reached a safe stage of its journey. It will be a charred and blackened looking ship that finally touches down at the Earth base. As shown in the lower right hand drawing a complicated temperature record panel for all parts of the ship's skin will be necessary. It will be one man's job to watch this and inform the pilot of all the variations that occur. The time taken is about 50 minutes from Satellite station to the atmosphere, and after five further minutes the crew will be able to look forward to a happy landing.



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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 21st July, 1956. No. 14.

A 'News of the World' Publication.

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And inside —

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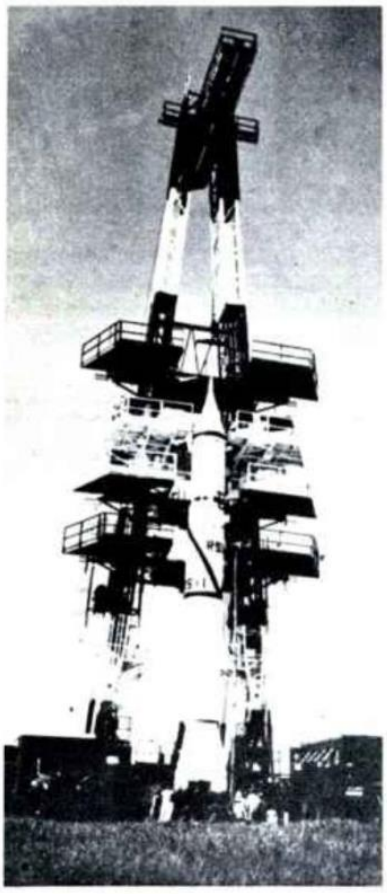
The Roving Camera Reports



Above: REACH FOR THE SKY, in which Kenneth More plays the part of Douglas Bader. He gets a reprimand from the prison camp Commandant and responds with steely independence. Eric Pohlman plays the part of the prison-camp boss.

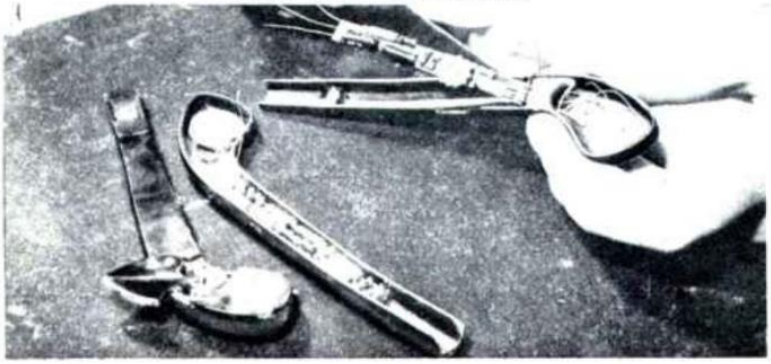
Right: KENNETH MORE has refused to leave the prison camp and when the Germans send a squad of men to remove him, he treats them as a guard of honour —and inspects them.

Left: REDSTONE, the American Army's latest bombardment missile ready for launching. It is 60 feet high.

HEAT BARRIER

The Bell X-2 has been specially designed to probe the heat barrier. It is expected to better the present unofficial record of 1,650 m.p.h. The cabin is detachable and the whole compartment can be parachuted to the ground.

SOUND BARRIER



The modern transistors are so small that a whole hear-aid equipment can be incorporated in the arms of a pair of spectacles.

Advertiser's Announcement

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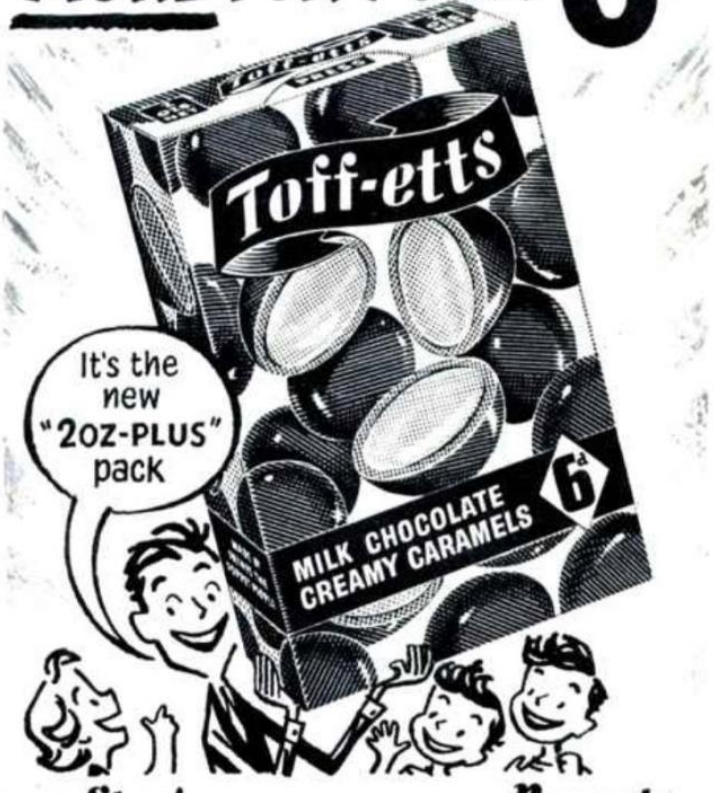


* Stop! at the Shop that has Poppets

Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

LANDING ON THE ASTEROID

SO far we have considered space travel and space craft suitable for journeys within the Solar System, and as far as we know our destinations are not likely to be suitable for beings accustomed to Earth life. The Moon, cold and hot alternatively with no atmosphere such as we need is an unattractive prospect as it stands. It can of course be developed, but it will be a purely artificial world. Mars also holds out no promises of a celestial El-dorado, Venus even less possible.

We shall have to go further afield, out of the Solar System altogether. Here in our Universe there should be room for plenty of possible perfect worlds suitable to our way of living and here our adventurous astronauts must travel. But not in ships driven by chemically fed Rocket motors. They are nowhere near fast enough for our purpose.

Long Journey

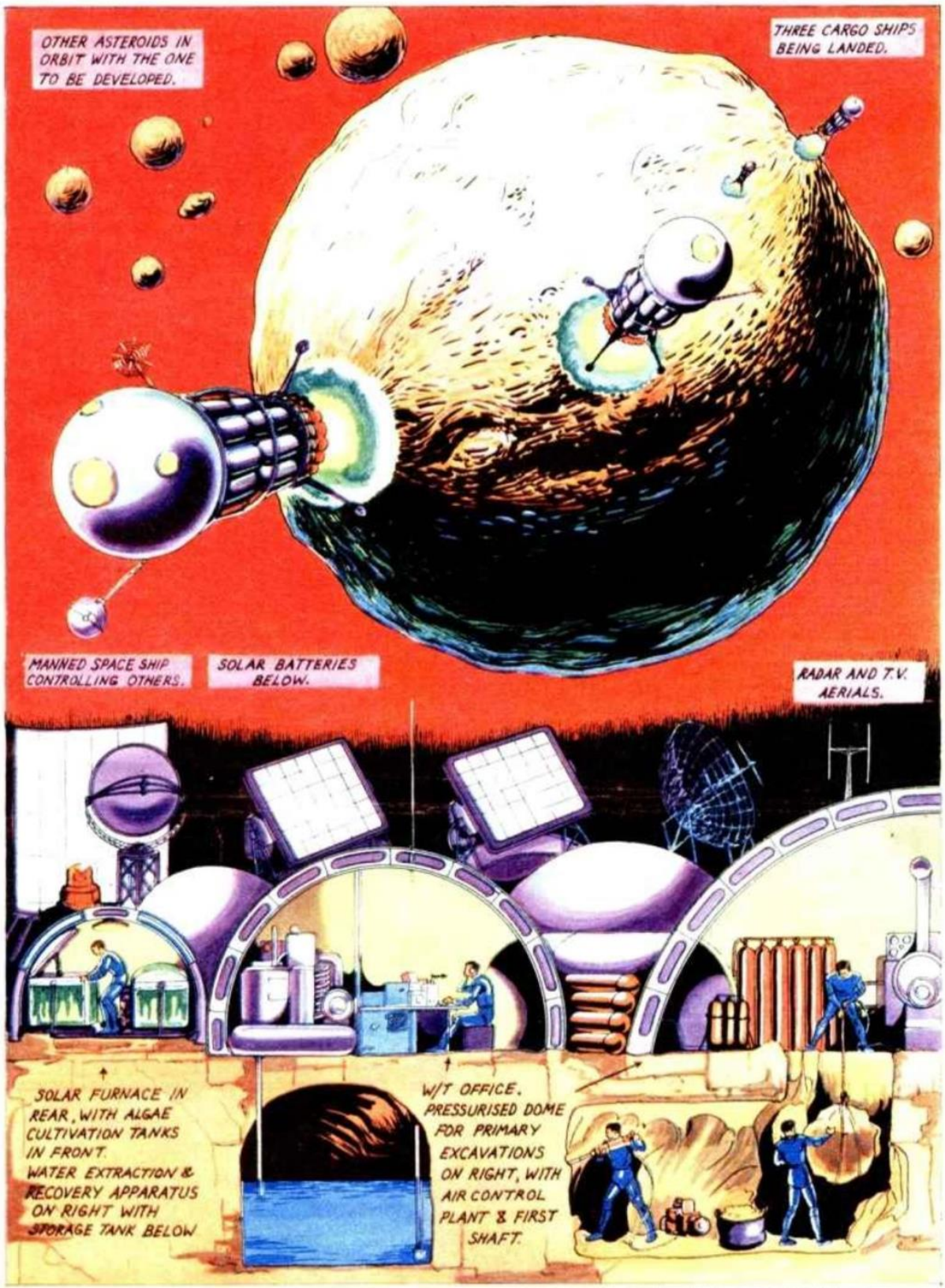
THE nearest star is Centauri and the time taken to get there using atomic energy at the maximum possible efficiency is quite a few generations. Indeed some experts reckon as much as 350 years. It is obvious that no ordinary conception of a ship would suffice to undertake a mission of this sort. But a manned asteroid is a different matter. This will come in time. But it will take a long time to develop a world in miniature—a bridge in time and space between our solar system and some other one.

Use of Asteroid

OF course this is not the only use for an asteroid. It can do all that a space ship can do, and a great deal more as well. It can replace the Earth Satellite station forming a much more efficient and comfortable base. It is ideal for trips to other planets as it will carry sufficient stores and personnel to ensure that no explorers get lost for lack of supplies or support. As it will carry its own industries it cannot run short of any essentials to life as we know it. It is a moveable world in miniature which can be projected anywhere in space.

The picture shows at the top the first working party landing. The manned spaceship with a crew of twenty men is landing three cargo ships by W/T control. The asteroid they are landing on is fairly regular in shape and about three or four miles in diameter. This may seem big at first but remember for really long distance travel this has to be lived on for years.

Below is a section view of the first attack, hemispherical pressurised domes of double walled glass fabric form the living accommodation and working air spaces. Three industries must be started at once. Water extraction and recovery; oxygen and air production and food production. The start of these is shown. The pioneers have landed stores and compressed air and water supply, but these have to be replaced by local production.



Food supply

ALGAE tanks will produce the first start in food growing. The Solar furnace will be used for industrial development of all kinds in the initial stages. The silicon type solar batteries will produce the first electric power, largely used for lighting and communications at this stage. Excavations will be done by manual labour, the very small force of gravity helping the excavator here. Next week we will consider the ultimate design on which pioneers of today are working.

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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 28th July, 1956. No. 15.

A 'News of the World' Publication.

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Across the Frontiers of Space

by Commander
J. YUNGE-BATEMAN, R.N.

☆ ☆ ☆

DESIGN FOR AN ASTERIOD

THE picture this week is intended to give an idea of what has got to be done to mobilise an asteroid. The journeys that may have to be taken are going to be something quite outside mankind's previous experience. There are going to be several novelties required for these long distance space ships. To start off with, chemical fuels as we now understand them are out. The present type of atomic reactor is not going to be much better. What is needed is what has been called the Ion rocket, using a direct form of conversion from nuclear to electrical energy, at a high efficiency.

Another problem

THE next problem is that the asteroid must be entirely self supporting and self developing. This means its crew will be a large and permanent feature of its economy, living on it permanently. So there will have to be arrangements for complete and satisfactory family life on it. There will be no room for passengers and non-workers in this economy. So here we have to produce a world in miniature capable of transferring all the essentials of our civilisation at its best to any part of space that we desire to go to. The power supply of course will be an atomic reactor used for developing electric power for lighting, air and water production, industry, etc. etc. This is shown situated right at the centre of the asteroid.

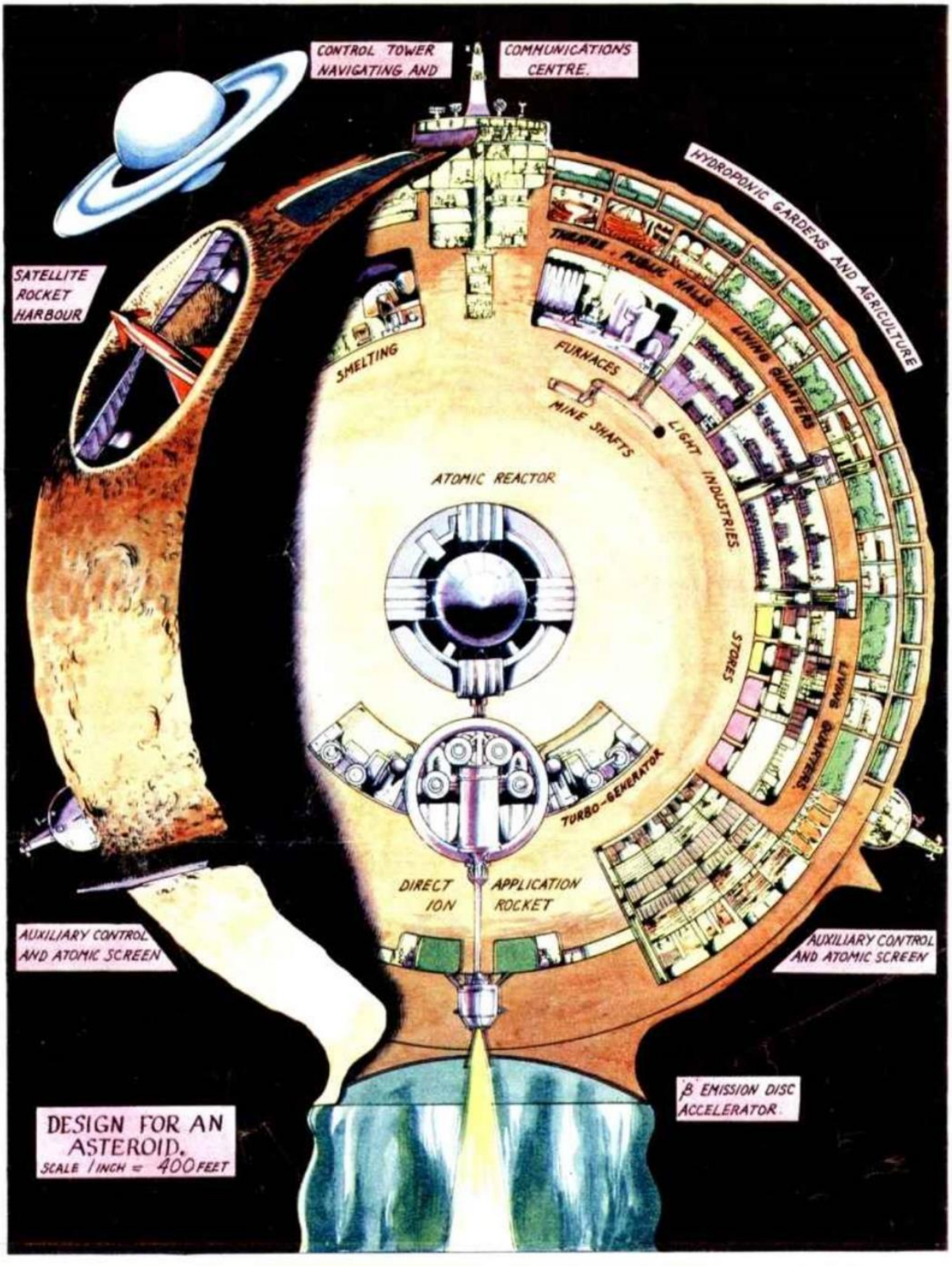
Self Supporting

BELOW this is the direct transference generator for producing high voltage electricity direct from atomic fission. This is for operating the Ion rocket motor shown with the propellant tanks and the B-Beta ray reflector at the bottom. This area will be screened by a high bank, as shown, from the rest of the surface. Auxiliary rocket motors, not shown, will be fitted on the circumference for steering or rotating the asteroid. As everything will have to be produced locally on this self supporting unit, a complete section of the necessary heavy and light industries will have to be carried. These are shown on the lower levels. Apparatus for the conversion of all waste materials to useful purposes will have to be developed. Water and Air production and purification plant is of course a prime necessity. These plants are not visible in this section. As the interior of the asteroid is developed the scale of these services will increase. Everything will of course be sealed off from outside space at atmospheric pressure. Careful checks and multiple air locks will be necessary.

More than Science wanted

NEXT to the surface will be the hydroponic gardens and agricultural areas and the living quarters. In time these will have to be developed into really pleasant and healthy surroundings so as to make life really enjoyable for the inhabitants of these asteroids. And here I feel that the feminine element of the crew will have a terrifically important and influential task. In fact it is difficult to foresee which of us is going to be the most important.

On a voyage into space that may take generations to complete, such things decide its success or failure. It is not only scientific advancement that is necessary for a successful journey into space.



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THE FIRST SPACE-AGE WEEKLY

4½D

Week Ending 4th August, 1956. No. 16.

A 'News of the World' Publication.

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ADVENTURE STRIPS and STORIES

CAPTAIN FALCON in "RENEGADES OF SPACE"

Planning a City in Space

by Commander
J. YUNGE-BATEMAN, R.N.

In this series Commander Yunge-Bateman adapts material collected by Herbert O. Johansen and Ray Pioch from the work by Darrel C. Romick, research scientist in the Goodyear Aircraft Company's aerophysics department. It is one of the first 'blue prints' for an inhabited space station.

HERE is an idea from an American source that is the very opposite to mobilising an Asteroid. In this scheme everything to be used in building this great fabric capable of housing and accommodating 20,000 people will have to be brought up from earth by satellite rockets. The scheme is extremely ingenious as it is a progressive design and in its first stages makes use of the rockets themselves as units in the construction. The picture will give the idea of how this terrific constructional job is to be started. Further instalments will follow the development through the various stages to the completion of a City in Space.

New Ideas

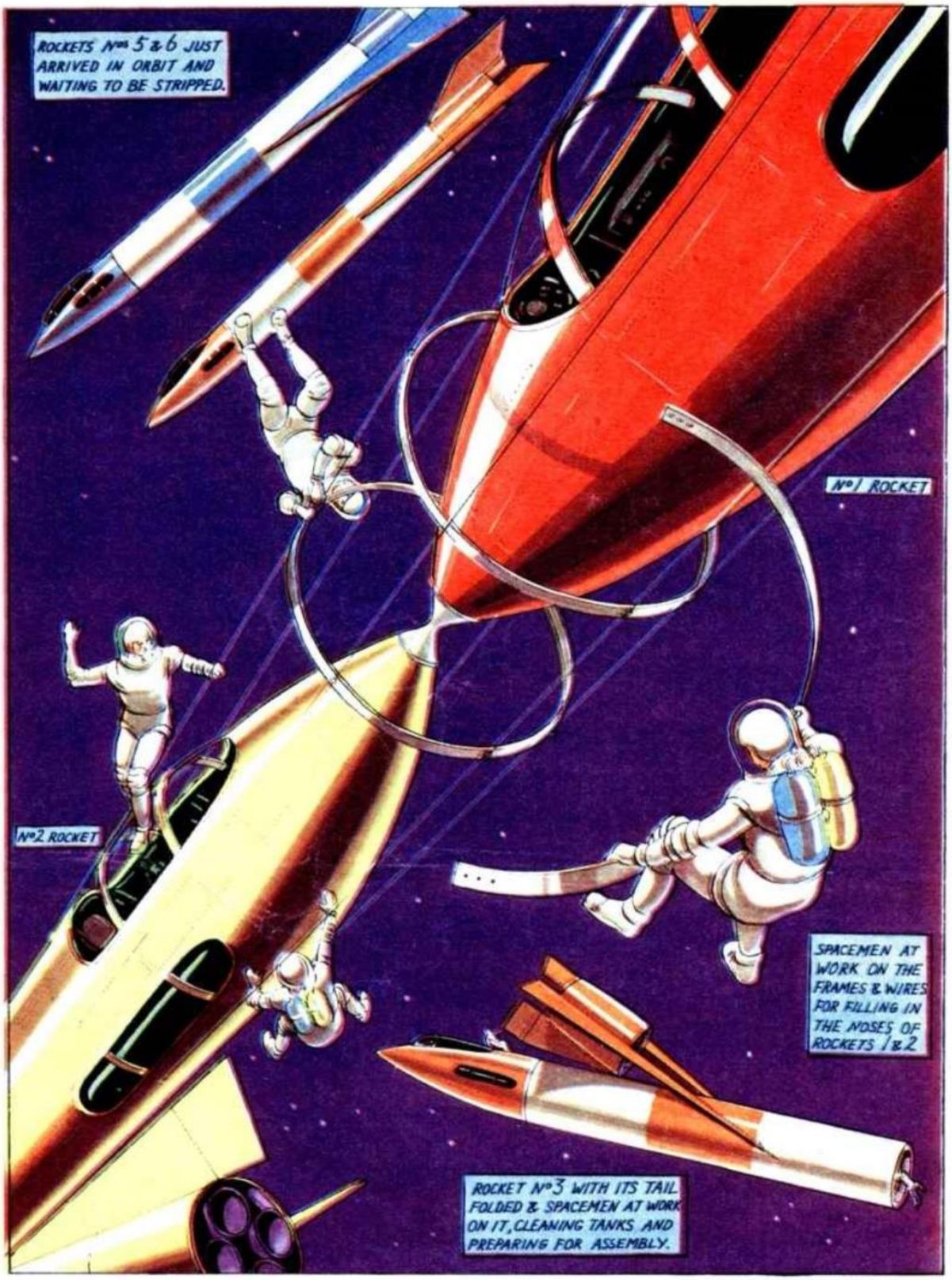
THE rocket itself differs somewhat in construction from the Satellite Rocket already described in this series. It is longer than the usual third stage unit and about nine feet in diameter. The tail fins and rocket motor housing are pivoted on to the main body and when the rocket is at rest in space can be disconnected and swung forward. The method of doing this is shown clearly at the bottom of the picture where Rocket No. 3 is seen after arrival, with its tail pivoted forward, the first thing to be done on arrival. The main fuel tanks are then cleaned out carefully and airlock doors assembled for the centre section. The rocket is then pressurised with air from storage bottles and forms a temporary shelter where the crew can live and work without space suits.

First Stage of Assembly

NOW the first stage of assembly is reached. Rockets Nos. 1 and 2 are nosed together, lined up and held by wire braces. The crews, working in space suits, then proceed to fit support rings on these wires and the whole section is skinned over with fabric sheets taken from the fins as they are dismantled. Once this has been made pressure-proof the two nose sections are dismantled from the inside, by men working at atmospheric pressure in their ordinary clothes. While this has been going on further rockets will have arrived carrying essentials in the way of food, water and air for the service of the spacemen occupied on the construction. These rockets too, are cleaned out, pressurised, their tails folded back and then joined up with Nos. 1 and 2 butting nose to nose and tail to tail alternately so as to form a long backbone as a foundation for the first expansion. This will be dealt with next week.

In Touch with Earth

LIKE all space operations of this sort the first stage is going to be extremely critical, and will call for great courage, determination and endurance on the part of the pioneer crew. They will be in wireless touch with earth base of course all the time, and as soon as possible will fit up a solar generator to supply their power needs. Their main troubles will be of course, water, air and food supply and special rockets of a more usual type will be using C.O.2 purifying gear so that their air supply, once built up, should be inexhaustible. But at these early stages they will be doing a lot of heavy work and the air consumption per man will be large. Although they will not be troubled by the weight of their materials out in space they still have to exert force to move a mass. Next week we see what progress our spacemen have made.



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AS we saw last week the first stage in building this Space City consisted in joining up the actual satellite rockets to form a backbone. The picture this week shows this backbone well on the way. The rocket motors and tail assemblies are swung back out of the way and the rockets are butted together, lined up and the nose spaces are now being rigidly framed with longitudinal struts over the ring-like ribs that were being fixed up last week. Material for plating over this framework is being taken from the skin of the rear fins. A completely airtight joint has to be made here as the inside of this backbone has to have air at a suitable pressure for comfortable living.

The Start

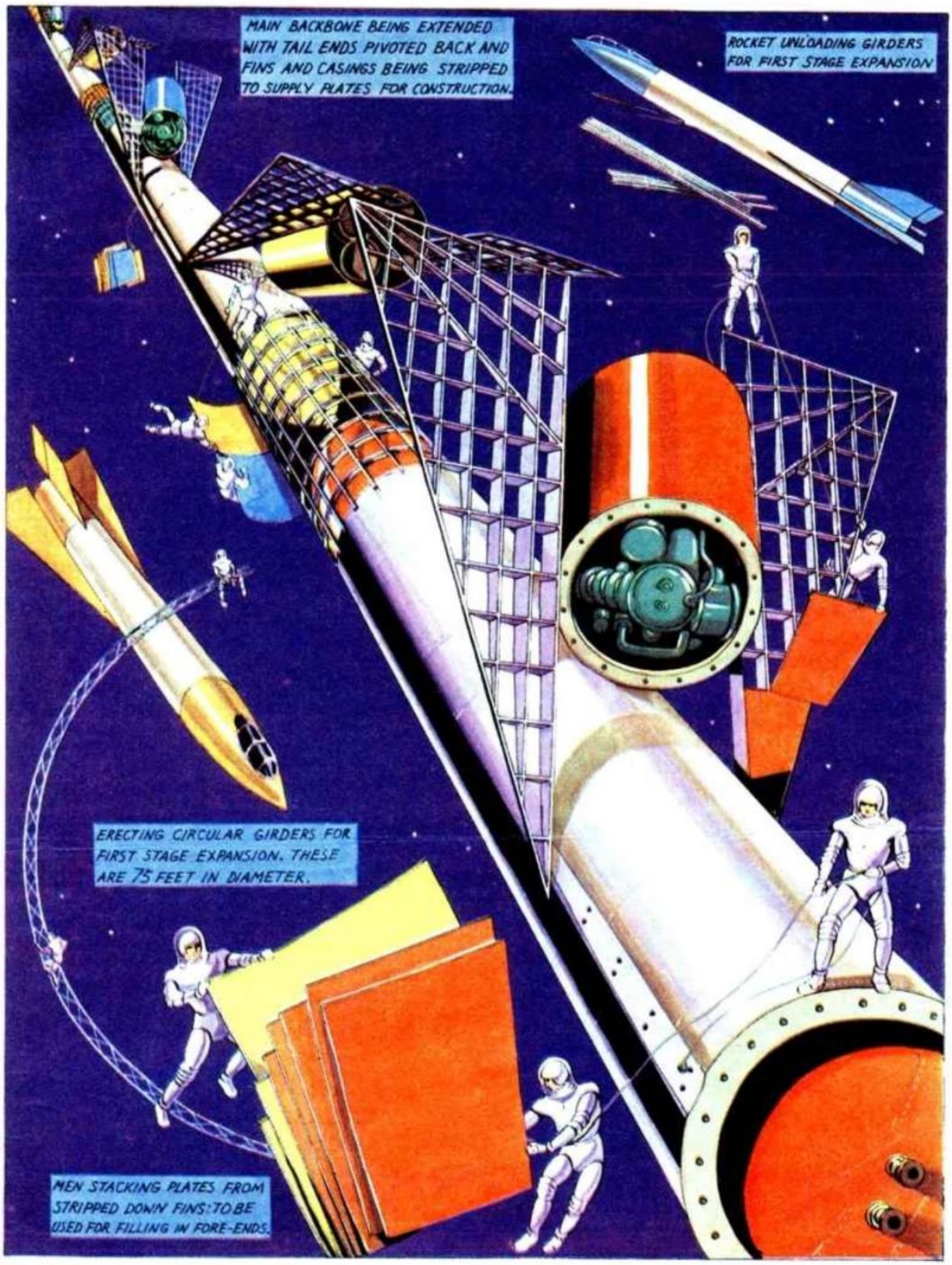
EACH of these rockets, less tail assembly, measures just over sixty feet long and sixteen will have to be assembled in space to form the start of the first expansion. After this we shall get a steady stream of supply rockets running a shuttle service to supply the assembly crew with the basic materials for their needs, both as regards living and also for the first expansion. Everything that can be used structurally in these sixteen rockets has been stripped down and stock-piled in space.

All material can be left where convenient, as it is weightless and problems of stowage are few. In the picture men are shown at work on the erection of a circular girder 75 feet in diameter. These will be constructed as far as possible with stripped down material but a large supply of prefabricated girders for these, the axial supports and the longitudinal struts, will also be required. The first rocket of this service is shown at top right unloading its cargo. These 75-foot wheels are to be fitted along the backbone one at each section and joined all around the circumference by the longitudinal girders to form the framework of the first expansion.

Stockpiling

THE rocket service is now busy stockpiling a large supply of sheeting for the skinning over of this structure. This actual operation will be dealt with next week. In the design which we are considering, it is proposed to have the structure in two parts. The one stationary in which all essential services, factories, workshops, scientific laboratories, astronomical telescopes, radar and so on is housed. This part will be at Zero for Gravity, and workers will have to be trained to become accustomed to working under these conditions, which are probably not so unnerving as some experts would have us believe.

The other part of the structure consists of a great wheel-shaped structure that rotates slowly about its axis and will thus apply a simulated gravity of the necessary amount. In this there are situated all the living accommodation, apartments, theatres, sports areas, gymnasiums and shopping facilities all in the very latest design. Here should be real comfort; an even, pleasant temperature, perfect lighting and pure unadulterated air free from all factory pollution that we get on earth. No insect pests either would be found as great care would be exercised to prevent the introduction of any form of life that would be hostile or irritating to spaceman. Next week we will examine the method of carrying out the first expansion from this backbone, and the start of the gravity wheel.



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No. 3

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THE first Expansion touched on last week is now in full progress. The first part of the Rocket backbone is now completed and measures 1,000 feet in length. It is fully air pressurised and is being used as a temporary living space by the construction crews. Notice the air lock door at the right hand end with the man at the entrance. The seventy five foot rings of the first expansion are in place and being plated over. As soon as each section of this is compiete the whole has to be closed in by an airtight bulkhead with airlock door for exit and entrance. This very much larger area has now to be supplied with pressurised air and the necessary machinery will be flown in by Rocket Supply train. The increase in available air space will enable the number of workers to be increased and the speed of erection will be stepped up as each section is completed.

Essential Services

ESSENTIAL services for air conditioning and water purification and recovery will be established in these central core spaces and will be added to as necessary as the work progresses and demands on these services increase. Some form of temporary hydroponic cultivation will be started to ease the pressure on food supply trains. These gardens will be shifted as necessary; no very difficult job as the set up is very simple.

Gravity Wheel

AS will be seen good progress has been made with the first stage of the Gravity wheel which is to form the home of these workers and dwellers in space. In its present form this wheel is five hundred feet in diameter and is built up on a tubular perimeter with girder spokes. This outer rim will form the commencement of the permanently occupied area in its final form. All space nearer the centre where gravity is low will be used for machinery space, for lighting, heating, laundries, waste purification and all the other plants that this highly artificial and high level living will necessitate. Automatic shutters for controlling the amount of heat absorbed by the walls of the wheel, from the sun are being fitted as the building proceeds.

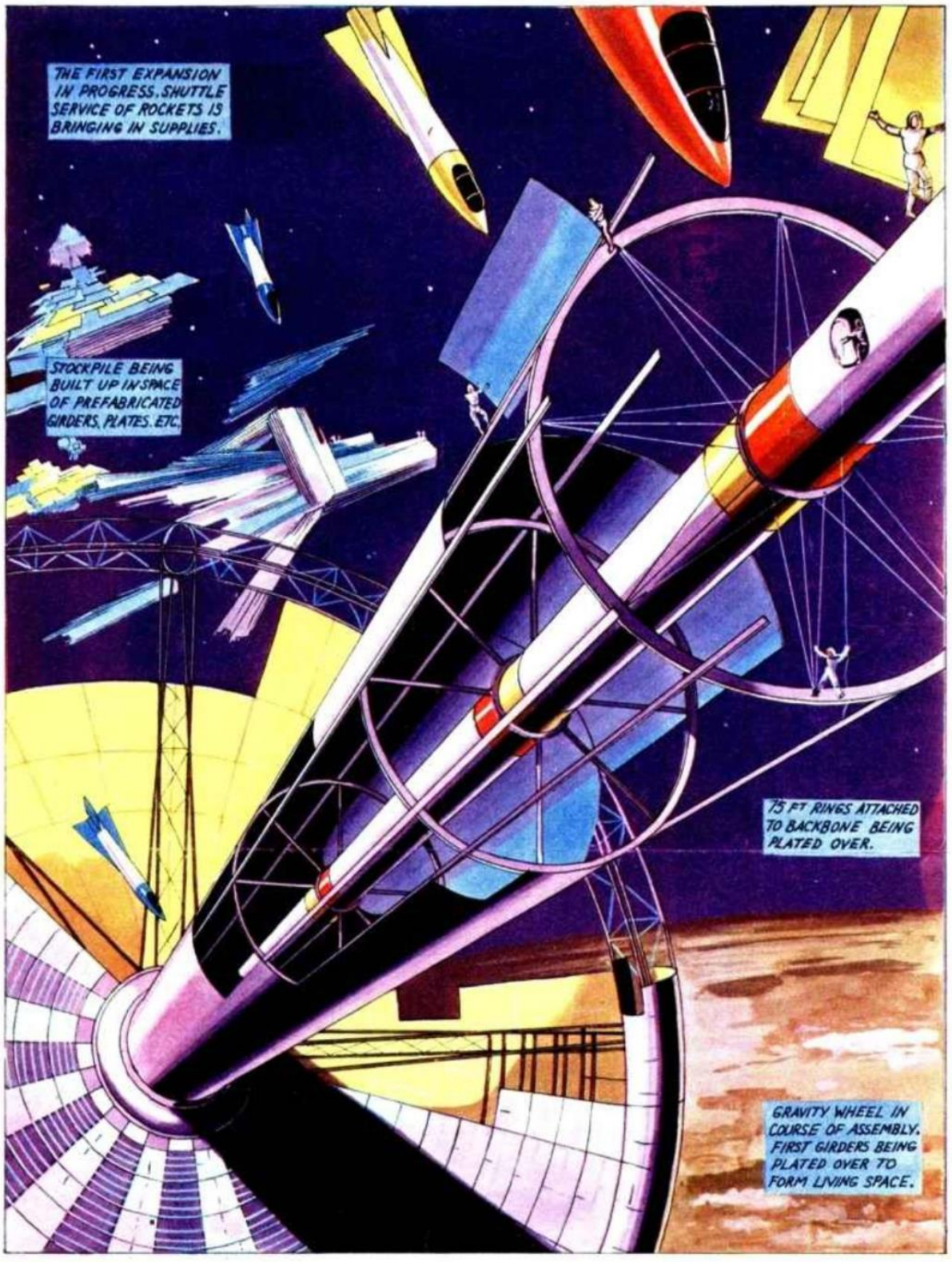
Stockpile

OUTSIDE surfaces will be aluminium finished to reduce heat absorption, inside surfaces will of course be finished in the colour and texture required by the function of the space they enclose. A large stockpile of prefabricated material is now being built up in space as can be seen on the left upper part of the picture. This is for the first expansion that is now going on and also to serve the terrific demands that are going to be made once the Second Expansion begins.

Normal Existence

A GREAT deal more work is going on under cover now. Living conditions will be more normal for the workers and maintenance men, space suits will not have to be worn and a lighting system will have been started so that the trying dazzling light and pitch dark shadows of space conditions will not handicap the space men. Once the expansion has developed sufficiently, the centre backbone formed of rocket bodies will no longer be used for accommodating the workers, but will be turned into a conduit for electrical supply mains, water services, and air conditioning.

The finished stage of the first expansion will be dealt with next week.



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No. 4

by Commander J. YUNGE-BATEMAN, R.N.

The First Expansion

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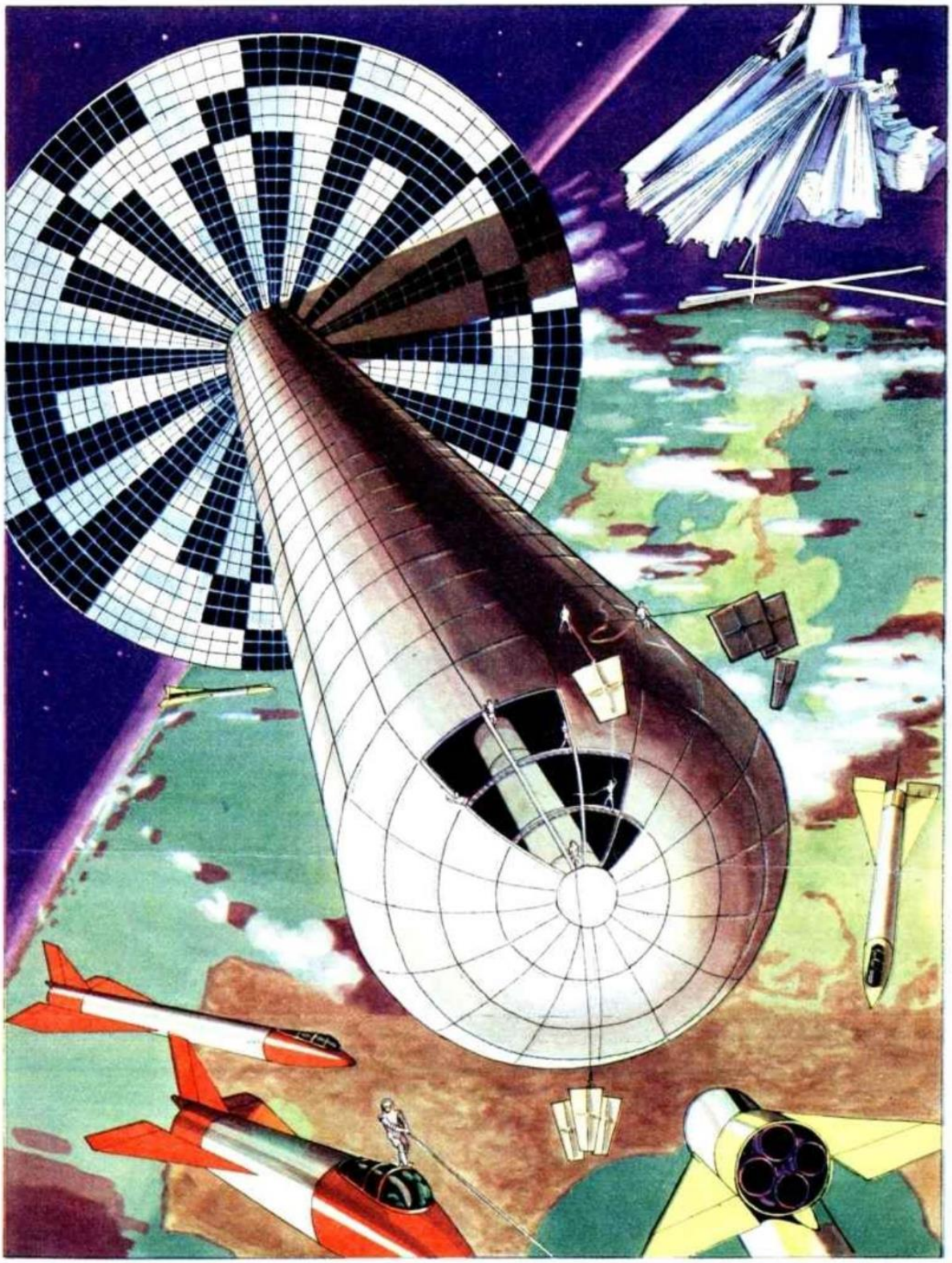

THE illustration this week shows the first expansion finished except for the few plates for the skin on the end. The length of the structure as it stands is 1,000 feet and 75 feet in diameter. Longer than the largest ocean liner but less in beam. So it will be seen that there is plenty of room already for a considerable number of people and the machinery necessary to maintain their needs. Besides this there is the wheel which has a diameter of 500 feet, and a thickness of 50 feet. There will be a pause in the building at this stage while the internal structure is proceeded with. A large supply of air is required for supplying this building and a complete air conditioning plant must be fitted in. Parts for this will be prefabricated on earth and rocketed out to 'The City'. Atmospheric pressure will be maintained which means that careful attention will be paid to the jointing in the skin, to ensure no defect in the pressure system. The design of the air conditioning system arranges for easy coupling up of extensions and duplicate systems for the final enlargement. The outer surface of the wheel is fitted with an elaborate system of reflective shuttering to control the absorbtion of heat due to the violent temperature changes experienced in space between sunlight and shadow. In the foreground of the picture rockets are being prepared, to be joined nose to nose and tail to tail to extend the backbone for the final enlargement. In the background at the top the stockpiling goes on, steadily building up all the necessary materials needed. The construction crew will now be of the order of six or seven hundred and as a considerable time is going to be spent, the organisation of the personnel will have to be carefully considered. It would be unlikely that reliefs could be ferried out and back as there is a large amount of material being moved and every extra pound adds enormously to the expenditure of fuel. So for these men and women out in space, recreational facilities will have to be provided. It is unlikely that at first energetic games will be needed as everyone will get their share of hard physical work. But T.V. newspapers, microfilm books, T.V. programmes of all sorts will be needed as here again the transport of material for entertainment will reduce the amount that can be carried for constructive purposes. For the same reason probably these pioneers will have to cut their smoking if it hasn't proved too much for the air conditioning at this early stage. Later, of course, the City dwellers will be able to grow and manufacture their own tobaccos by hydroponic culture. In fact it is one of the most interesting speculations in space development, this starting of scientifically controlled arts and industries under absolutely artificial but scientifically perfect conditions. All the chance happenings that spoil such efforts on earth due to uncontrollable weather, insect, bacteriological or virus pests and all the rest should be eliminated, and results would be surely forecast. Industries could be run under ideal conditions, automation being an essential element in all procedure at the start, where every worker is worth fabulously more than his weight in gold. Next week we will see the final Enlargement in full swing.

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No. 5

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The Final Enlargement

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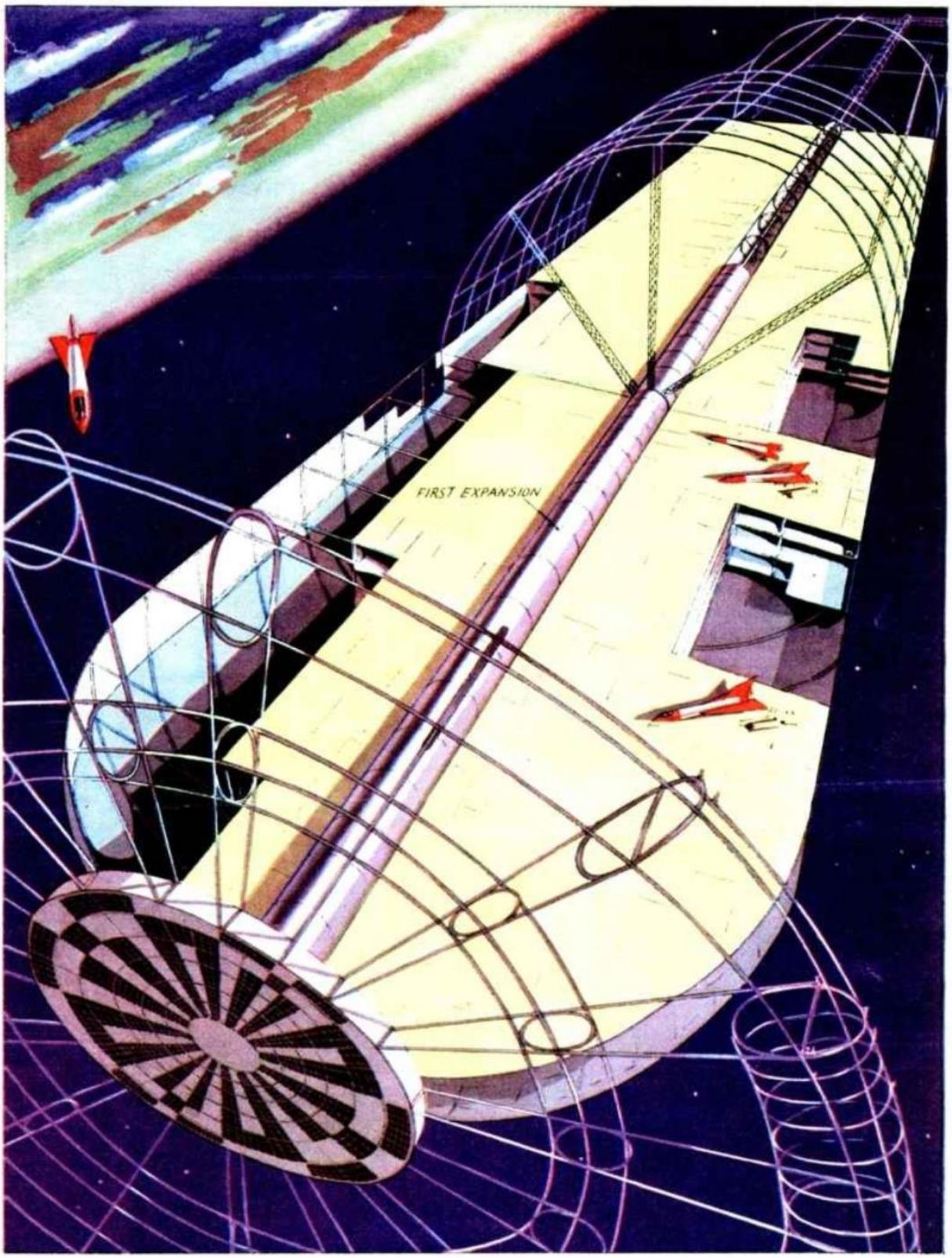

THIS week the picture shows the final enlargement in full swing. A great deal has been done since the last stage was shown. The completed first Expansion is still quite clear. It forms the hub of the Gravity wheel and the 75 foot diameter backbone running up the centre of the structure. In its first stage it was 1,000 feet long. Now it is being extended to its full length. The second 1,000 ft. section has been half completed and the rocket's first stage is shown with the ring shaped frames all set up. The third 1,000 foot section is in the first stage with the frames being added. This completes the expansion for length the final structure having been designed for 3,000 feet. This division into three parts is retained until the end, each one air tight and separated from the other by air locks, for safety. Expansion is also proceeding in width all along the backbone. This is much more like modern building methods to look at. A wide flat rectangular structure is built on to the first expansion backbone, divided up into sections and compartments. The design of these depending on the functions for which they are intended. Remember that this part of the structure is to be occupied by the industrial and public services machinery and office space and the layout will naturally resemble some form of modern industrial design modified by the special conditions out in space. It is important to remember these as otherwise the design of this city is apt to appear fantastic. We have no problems here of weight of the structure or the load that the structure is going to carry. Thus the backbone is not going to bend or sag because we erect a large structure at one part of it. Nor will it bend of its own weight as it would on earth. Nor in the construction work is it necessary to have these vast cranes that we are accustomed to see to lift the great girders around. All that is necessary is to move the material from one position to another and no very great force is required for this. As a consequence a lot of the building activity is going on inside the structure under cover. This is also likely to be so, as workmen and material on the outside are liable to drift off into space due to accidental forces received unless roped to the structure which is not always convenient. Erected on this flat platform are the immense circular girders for the outside skin of the structure. These are shown in the picture on the second 1,000 ft. section, for the sake of clearness. Normally they would also be covering in the first section as well. The lower part of both the first and second sections has been ribbed and skinned over. The final shape of the structure is a vast cylinder, with rounded ends and a great wheel at one end. The girders for the expansion of the wheel are shown in place, ready to be skinned over. Supply rockets can now land on the structure and unload their materials directly into the building. Most of the supply dumps shown in the last picture have been absorbed into the structure. As time goes on more and more is added to the internal structure as the various industries and activities require more space, until finally it will fill the whole skin 3,000 feet long and 1,000 feet in diameter. A picture of the completed structure is given next week.

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No. 6

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The Completion

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THE drawing this week gives a general view of the final enlargement with a distant view in the top left-hand corner. Except for the hub of the wheel no part of the earlier stages is visible. The whole of the outer skin is completed and also the additional meteor bumper which is calculated to break up the tiny meteoric particles that are expected to be normally bombarding the structure. Most of these fragments are minute and on colliding with the meteor bumper they will become incandescent and disintegrate before they reach the real skin, so great is their speed. Thus the danger of puncture of the pressure skin is reduced to a very small chance and any punctures that do occur can be dealt with by the skin maintenance crew.

Temperature Control

A LARGE part of the surface of both the wheel and the zero gravity structure is taken up by temperature control shutters which are very noticeable in the drawing. Large areas are also covered with deep blue transparent plastic. These cover the hydroponic gardens and farms where food is grown for the population and animals kept to supply meat, milk and chickens for eggs and the table. This city in space is a large community of as many as 20,000 people. The government and welfare of these Space cities will have to be specially developed for the type of community it houses. Space politics will require careful study. It is obvious that in a highly complicated artificial existence such as must be led, the amount of freedom of the individual to behave in an irresponsible way, such as can still be tolerated on earth will be severely curtailed. Failure to obey safety regulations with regard to air and water supplies could produce disaster for all. However, it should be possible to give compensations for these curtailments of personal liberty so as to make them tolerable for most people. And those who cannot get along will have to be politely but firmly removed to environments where they can do less damage.

Landing Deck

IN the rounded end of the Space City is the Rocket landing dock. Several rockets are seen being manoeuvred into position. Two red Rockets have just blasted off to carry out the daily Earth Ferry service. The disturbances caused by the arrival and departure of rockets will require careful checking as adrift may develop and the city become moved from its correct position. Control Tower will be responsible for routine position checks and will take any necessary action to correct errors. Several blister structures are noticeable on the main body of the City. These are astronomical and terrestial observatories and communication domes. Armed with optical and electronic telescopes they will house a body of scientists and research workers, busily collecting data and passing it on to Earth headquarters.

Normal Conditions

THE gravity wheel is now spinning at the predetermined speed to give normal conditions for all people accustomed to the earth. Here all that can be done in the way of home planning and social organisation is combined to make Space life really worth while. With careful Air Conditioning the dweller in Space will be free of all the irritations of unpleasant weather. Neither too hot nor too cold, good light at all times, no snow or rain. The weather will be adjusted to suit the Citizen. Also pests such as flies or mosquitoes and other horrors need not be tolerated. It will need careful supervision at the Rocket landing stage to see that no pest is allowed to slip in past the air locks. This will be a normal part of the duties of the Health Officers. Next week we will consider the mechanism of the Gravity Wheel in more detail.

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Planning a City in Space

No. 7

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The Gravity Wheel

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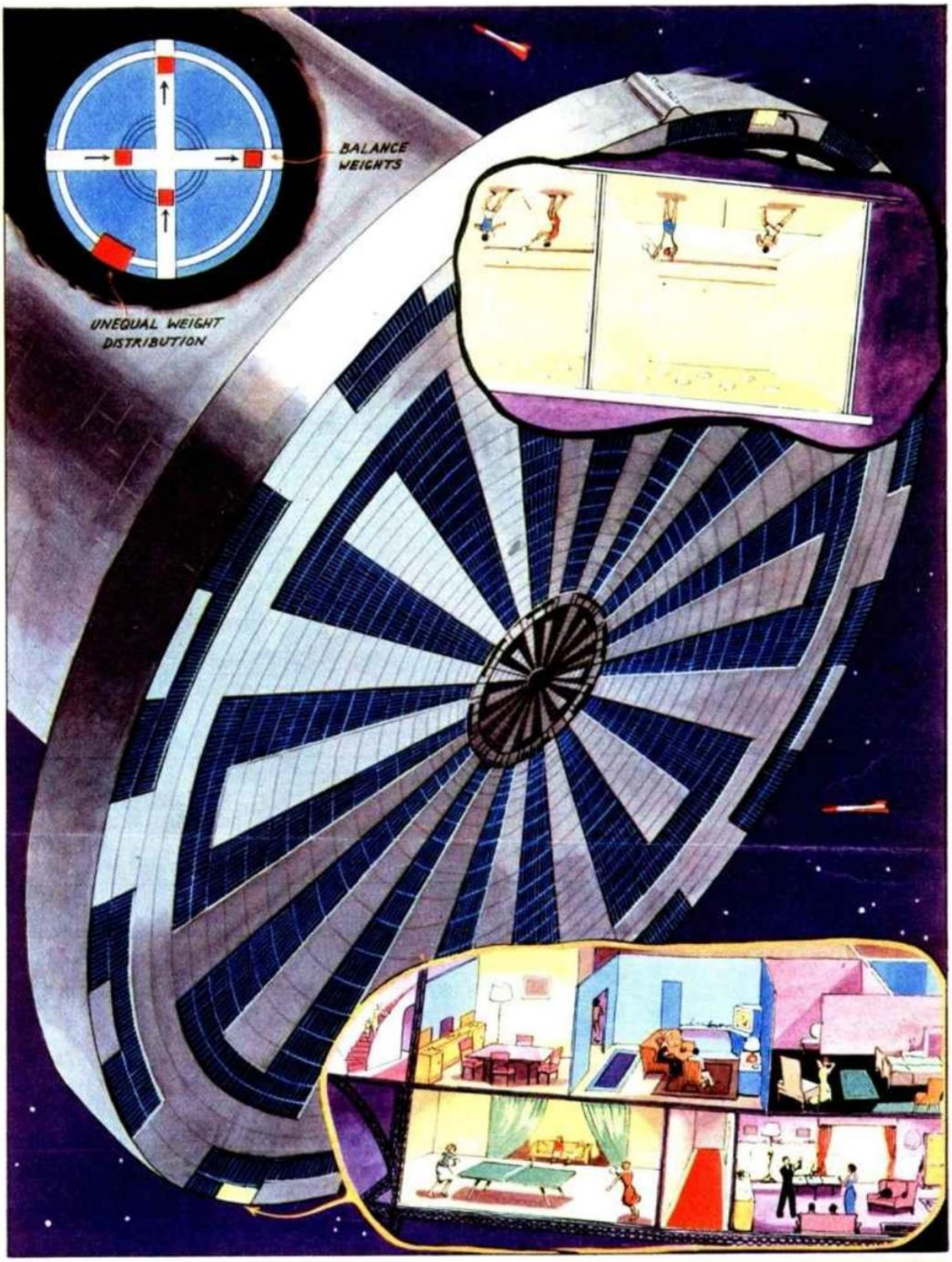

THIS week we are having a look at the gravity wheel. Fifteen hundred feet in diameter it is quite a big structure and its circumference is getting on for a mile. This business of producing an effect of gravity by rotation has cropped up before. For instance in the space station described in 'The Rocket' which was to be used as a take-off depot for space ships. In that case once the rotary motion was applied the structure continued spinning as it was freely suspended in space. Here, however, the Wheel is attached by a hub to the fixed position of the Space city. This will introduce friction and some means must be devised to overcome this. At the top of the wheel is a small mound-like structure on the rim. This is one of the motor houses for the small jets that will be required to start and continue the motion of the wheel. They will be operated automatically. Any slowing down or quickening of the speed of rotation will affect the jet throttles.

As mentioned earlier, the purely domestic parts of the building; that is where Space people are to live, sleep and have recreation, will be situated on the rim of the wheel. This will allow about five hundred feet in depth being available. The reason being of course, that the closer we get to the hub the less the pull of centrifugal force for a given rate of turn. The space is not wasted however, as all the air conditioning plant, temperature control mechanism, store-rooms, purifying systems serving the moving part of the city will be situated nearer the centre. There is also room for further gardens and so-forth. To emphasise the odd way one lives on a space wheel, there are two enlargements of living spaces shown as insets on the picture. At the bottom is a flat with dining room, T.V. and music room, bedroom and lounge and a games room with people playing table tennis. They will experience no difference in feeling to people living on the earth but, of course, 'down' for them is always 'outwards' towards the rim and away from the centre. That is why the men playing squash rackets on the opposite side of the wheel are upside down, although they do not feel that way. To them they are just as much the right way up as the people opposite, and are subject to just the same forces as if they were playing their game of squash on earth.

In the top left-hand corner of the drawing there is a diagram to show how the changes in weight distribution of the wheel can be countered. Should a large number of people mass together, such as would occur in the theatre or assembly rooms, the balance of the wheel would be upset to a dangerous extent. This is overcome by having four shafts at right angles as shown, each carrying a counter-poise weight. By shifting these weights in or out from the centre correct balance is perfectly restored. Similar adjustments would be necessary to allow for consumption of stores, alterations to the structure or to the number of people in residence. The dark sections of the wheel are the temperature control shutters which adjust themselves automatically to reflect or absorb more of the sun's rays as the temperature of the air in the wheel requires it. The wheel is separated by a moving airlock from the fixed part of the city and forms a different air system.

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by Commander
J. YUNGE-BATEMAN, R.N.

The Air Dock

In this series Commander Yunge-Bateman adapts material collected by Herbert O. Johansen and Ray Pioch from the work by Darrel C. Romick, research scientist in the Goodyear Aircraft Company's aerophysics department. It is one of the first 'blue prints' for an inhabited space station.

A MOST important part of the Space City is the Air Dock. This is situated, as we saw earlier, at the rounded end of the Static Section, at the other extreme to the Gravity Wheel. Its importance is due to the fact that this type of Space Colony must to a certain extent depend on imports for its existence. Unlike the asteroid developed over a long period of time, it can never become entirely self supporting. This conception allows for quick construction, say three to five years, but means sacrificing complete independence.

As seen in the picture the Dock consists of two decks with the Control Tower and subsidiary buildings in between. Each deck has an air lock docking entrance and an air lock controlled take-off screen.

Docking the Ship

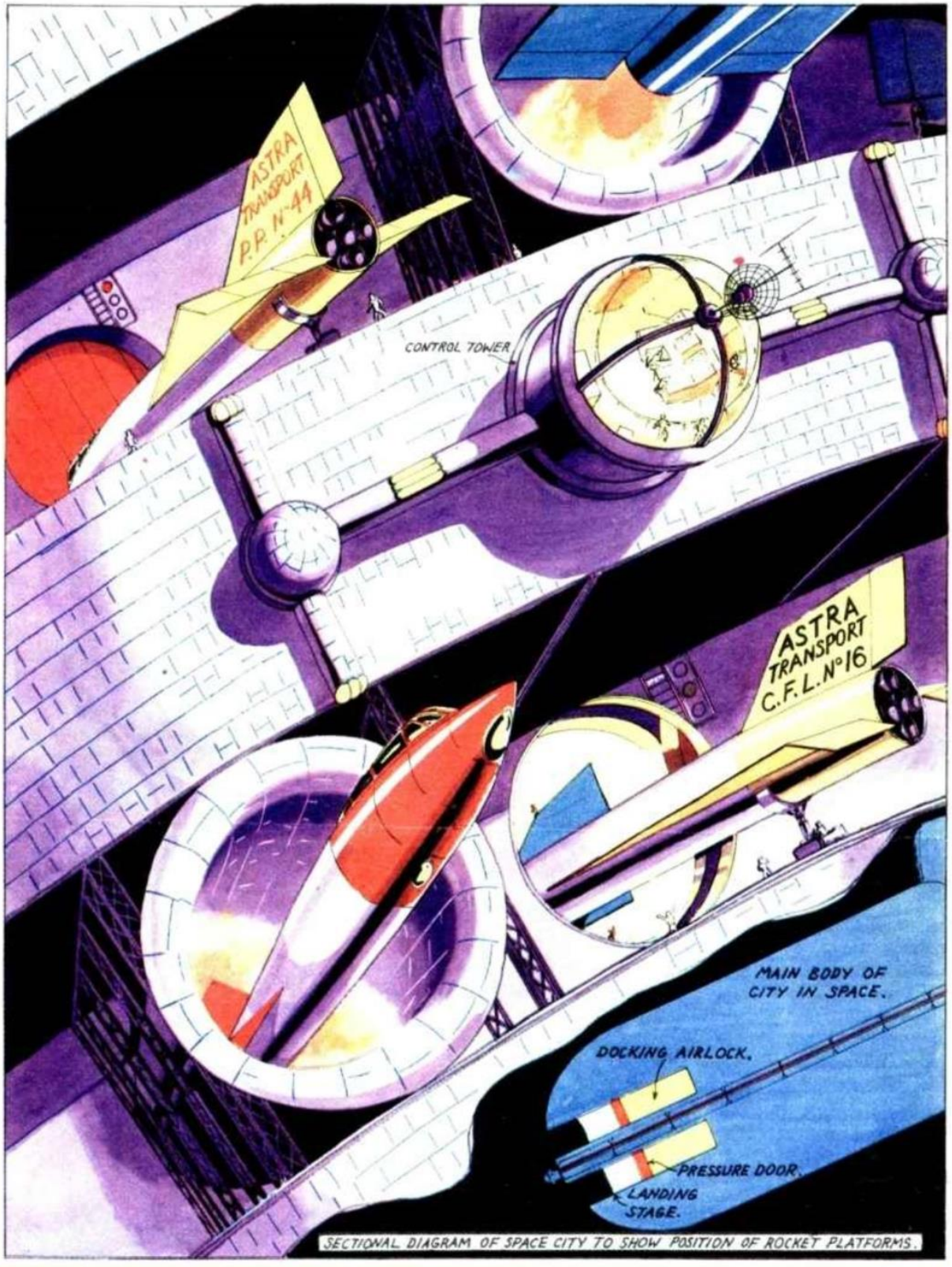
A ROCKET ship on arrival coasts gently in to the deck ordered. Here she is taken over by the docking party who see her manoeuvred into her cradle. The rear part of the cradle is easily seen holding both the Astra Transport ships with yellow tails. These cradles are magnetic and draw the rocket into place and hold it firm so that it can be manoeuvred in this gravity zero field: they run on rails. The docking air lock is now exhausted, the pressure door is opened and the Rocket is run in to the inner part. The pressure door is then closed and the air lock put at atmospheric pressure. The crew can now disembark and unloading can be carried out in normal conditions.

Blast Protection

THE departing rockets reverse this process, but are put through a different pressure door and emerge into the take off screen. This screen is intended to protect the dock and also the dock crews from Rocket blast. Normally a very short, throttled down blast on the motor is used just sufficient to overcome the inertia of the big rocket ship and send her gently clear of the City. When she is at a safe distance she will open up her throttles for the 'blast off' to leave the Orbit of the City and carry her on her homeward journey. Unless compensated, the thrust of the departing ship would transmit motion to the City in the opposite direction. So control will fire a compensating jet to eliminate this motion. The tail of a blue rocket is seen just leaving the take off screen, top right; and a red rocket is moving out from the take off screen bottom left. A diagram of the layout is shown bottom right.

Health Outlook

THIS City is going to be free from a lot of the plagues and nuisances that beset us in this world. Influenza virus, and flies, plant pests and so forth have no place in this planned economy. So that both on leaving earth and on arrival at the City a most careful inspection of goods and passengers will have to be carried out. This process of safeguarding the health, comfort and the prosperity of the Space dwellers will take place in the docking airlock area before admission is gained to the main occupied areas. All materials, goods and supplies will be very carefully checked before admission. The air from the lock will be passed through filters before being returned to the main body of the City.



SECTIONAL DIAGRAM OF SPACE CITY TO SHOW POSITION OF ROCKET PLATFORMS.

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Planning a City in Space

No. 9

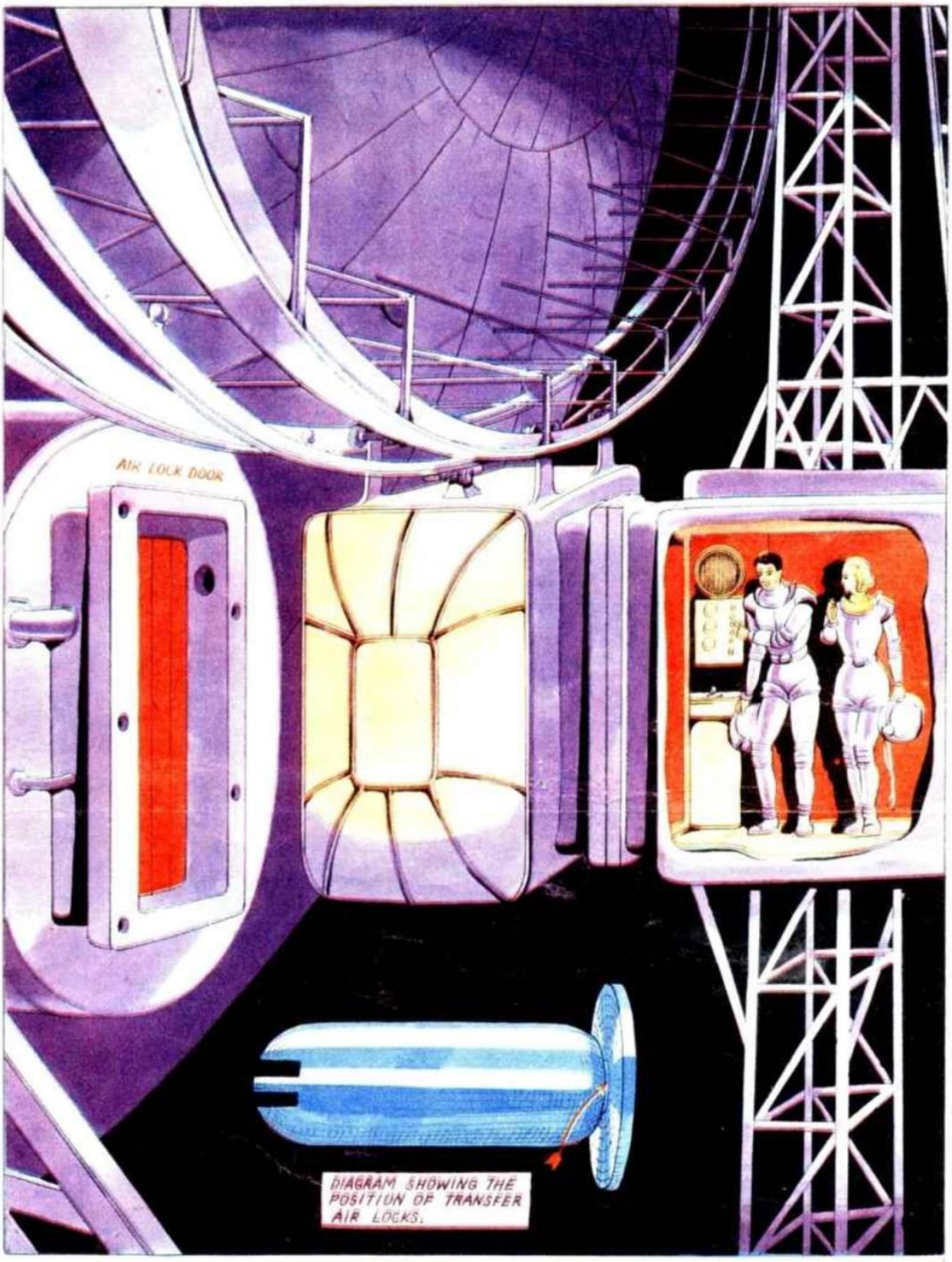
by Commander J. YUNGE-BATEMAN, R.N.

The Transfer Cage

In this series Commander Yunge-Bateman adapts material collected by Herbert O. Johansen and Ray Pioch from the work by Darrel C. Romick, research scientist in the Goodyear Aircraft Company's aerophysics department. It is one of the first 'blue prints' for an inhabited space station.

THERE is quite a little problem in the design of the Space City and that is; how to get from the moving part, the Gravity Wheel, to the larger Static part. The solution is shown in this week's picture. It is really a form of the ordinary lift, but adapted to run on a continuous circular track instead of up and down. To start off with the joints at the stopping places must be so arranged that a pressure proof contact can be made. Then an airlock is placed on the static part and one on the revolving part. These are shown in the picture, that belonging to the rotor is on the right, attached to one of the spoke like girders. The one belonging to the static system is shown on the left. In practice, of course, there would be a number of these, according to requirements.

* The transfer 'Cage' is shown in the centre. Actually it is not a cage but a solid sided vehicle, pressure proofed and with a pressure door on each side. It runs, driven by an electric motor, suspended on wheels on rails that make a circular trackway attached to the end of the Static section which can be seen as the bulging circular part in the background. The suspension from the rails is so arranged that when the transfer cage is stopped at a Static or no gravity station, there will be no possibility of the cage coming free of the wheels due to the movements of the occupants. Wiring connections will be via the hub of the wheel. All that the space dwellers have to do is to go to one of the air locks and press a button for the transfer cage. It will then arrive, lock in; the door will open and they can pass into it, just like passengers in a lift. Another button to press and the lift takes them to the air lock on the Static section. Here they find themselves transferred to a no gravity environment and proceed to leave the transfer cage through the air lock. The change from one state to the other will be worse than ones first experience of a high speed lift, but the two citizens shown are hardened space dwellers and can 'take it'. They are rocket crew going to board their 'ship' for a return trip to earth, hence they are wearing their space suits and carrying their plastic helmets, having changed in the comfort of their flat in the gravity wheel.



This completes our survey of this answer to the problem of how to live in space in comfort and with a high standard of living. It should always be remembered that pioneer conditions in space are only to be tolerated for as short a time as possible. Man is going to spread the best of his civilisation into space, and to keep it and improve it. There must be no deterioration of culture tolerated. We want no space slums.

* The position of the transfer machinery is indicated in the diagram at the bottom of the picture.

STARTING NEXT WEEK

Another Ley Kenyon thrilling underwater serial — THE TEMPLE of the SUN — when Professor Jack Ransom, Tom & Jeff investigate

THE MYSTERY OF INCA GOLD!

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WEEK ENDING 6th October 1956. NUMBER 25.

THE TEMPLE OF THE SUN by Ley Kenyon P. 16

CAPTAIN FALCON in "THE SCOURGE OF SATURN"

BRICK BRADFORD

BY CLARENCE GRAY

• THE AILING RULER OF OSTAR, AROUSED FROM HIS SICK-BED DURING THE TUMULT OUTSIDE THE PALACE, SUCCUMBS TO A SATELL-CELL BROUGHT DOWN BY THE CONTROLLING INVADER •

HOW CONVENIENT THAT THE KING HIMSELF CHOOSES TO JOIN MY GRAND WELCOME! HOW CARELESS OF HIS STAFF THAT HE IS UNATTENDED! HOW EVIDENT THAT OSTAR NEEDS A NEW EMPEROR!

1

• GUIDED BY THE INVADER'S STRANGE POWER, FAIRLA STEPS DOWN AND THE KING ASCENDS THE PODIUM •

MUCH BETTER THAT MY SLAVES HEAR AND SEE FOR THEMSELVES THEIR OLD RULER ABDICATE FOREVER!

2

• INSIDE THE MASTERSHIP, BRICK AND CRICKET, SEEKING OUT THE MASTER CONTROL PANEL, FIND IT .. AND ALSO A STRANGE SIGHT •

GEE! AN OLD MAN OPERATING THAT GIANT BOARD, BRICK!

BUT AS A PUPPET, CRICKET! SEE!! HE TOO IS GUIDED BY A SATELL-CELL!

3

OPEN FIRE, CRICKET!! BLAST EVERY TUBE AND INSTRUMENT YOU CAN GET A BEAD ON!!

4

•IT IS AT THIS MOMENT THAT FAIRLA'S FATHER THE KING IS ABOUT TO CONCLUDE A TRAGIC ADDRESS TO HIS ENSLAVED PEOPLE •

SO, OSTRONIANS ALL— I SHALL FALL AT YOUR FEET IN HONOR OF THE NEW--AH--AH--

5-1

CONTINUED

5

Strange AND True

PEOPLE USUALLY THINK THAT THE APPEARANCE OF FLYING SAUCERS IS AN ULTRA-MODERN PHENOMENON.

FAR FROM IT. STRANGE OBJECTS HAVE BEEN SEEN IN THE SKY SINCE ANCIENT TIMES. JULIUS OBSEQUIS, AN EARLY ROMAN ANNALIST OF THE 4TH CENTURY A.D. WRITING IN HIS BOOK 'PRODIGIORUM' REPORTS, AMONGST MANY OTHER TYPES OF OBJECTS, THESE :— IN B.C. 216 A ROUND SHIELD WAS SEEN IN THE SKY AT ARPI. ALSO IN B.C 99 A ROUND OBJECT LIKE A CIRCULAR SHIELD TOOK ITS PATH IN THE SKY FROM EAST TO WEST. THE DRAWING ON THE RIGHT SHOWS HOW LIKE A ROUND SHIELD IS TO THE FLYING SAUCER ON THE LEFT.

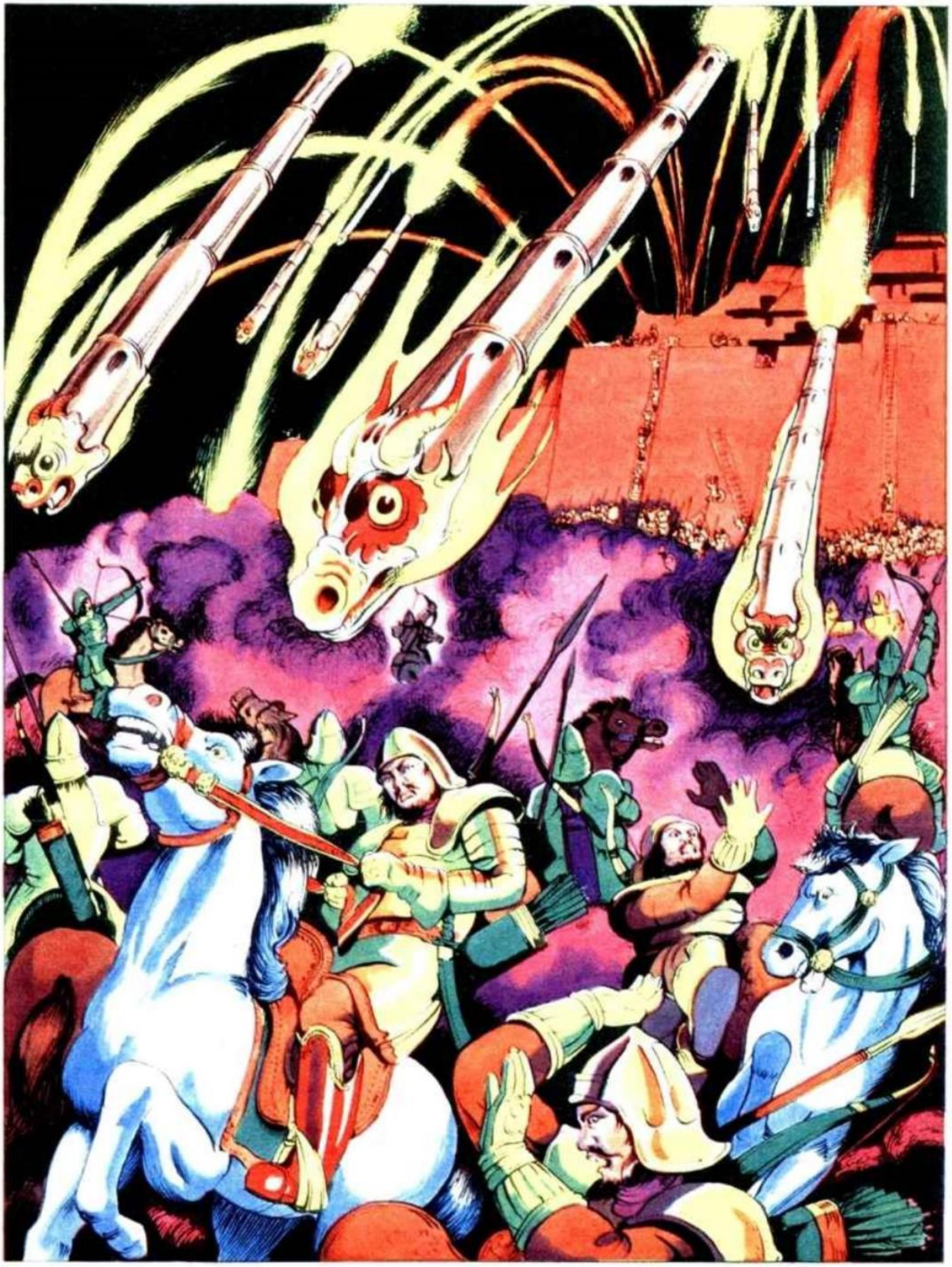
A.D. 1956.

B.C. 99.

The History of Rockets

No. 1

by Commander
J. YUNGE-BATEMAN, R.N.



NOT everybody knows just how long rockets have been going. It is probably a fact that they were used as a military weapon before guns were invented, so they are of a respectable antiquity. The discovery of gunpowder is usually attributed to Roger Bacon in the year 1242 A.D. Whether this claim is still made in schools or not it is pretty obviously a mistaken one. He did, however, improve on existing formulae and produced a much more efficient mixture. Compounds of the same sort had been known and used in the East almost from the earliest recorded times and it is only reasonable to suppose that they were employed for warlike purposes even then, as mankind has always been quick to adopt any invention as a weapon. Such things as "Greek Fire" and "Chinese Fire" are obviously something of the sort. Also in early myths one is frequently coming across destructive weapons of more than ordinary capabilities. Jove's thunderbolts being just one of many. Particularly do they crop up in Eastern Folk Tales. If one studies early histories it would seem that long before our era, Chinese, Persians, Arabs and Greeks used some form of rocket, for signal purposes. Even in combat actions it seems likely that firework experts produced fire balls and rockets for incendiary purposes. What led to the discovery of the principles involved in producing and using a rocket we shall probably never know and guesses about the subject cannot be very useful. But we can be quite certain of the antiquity of the whole affair.

However, to start this survey of the History of Rockets the subject chosen is taken from a mention made in a Chinese chronicle which describes the use of rockets for military purposes in the year 1232 A.D. at the battle of Pei-Ping against the Mongols. There is also another reference to them being used against the same enemy in 1225 A.D. The picture this week illustrates an episode in this battle. In the background are the walls of the city illuminated by the fiery glow of the rocket trails as a large salvo is let off at a concentration of Mongols attacking with scaling ladders. True to Chinese practise of the time, these weapons were intended to frighten as well as obliterate the enemy. In fact, the efficiency of these weapons was pretty low and the psychological effect on untried troops and the terrifying of horses probably outdid any material damage they could produce. The dragon and lion heads attached to them would be added to enhance their frightfulness.

The rocket consisted of a long bamboo tube with gunpowder filling used as a solid propellant. The head could be a fire-pot to scatter burning pitch or other incendiary material or it could be used with some sort of explosive head to explode when the fuse had burned through. The rockets shown have incendiary heads, the flames coming from them adding to the 'terror' of the attack. These weapons could not have been at all accurate and the only chance of damaging a given target would be in loosing off a large number of hits. Indeed, the use of these rockets by the Chinese probably did not alter the course of the battle much: the Mongols being a very tough and highly efficient fighting force, who knew all there was to know about military tactics at that time. We shall see that the rocket has had a fluctuating history, being eclipsed by the cannon on more than one occasion, but always bobbing up again, due to some improvement, until now it looks like eliminating the gun altogether. Next week we will take as a subject the first use of rockets in Europe.

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